STANFORD ICHTHYOLOGICAL BULLETIN

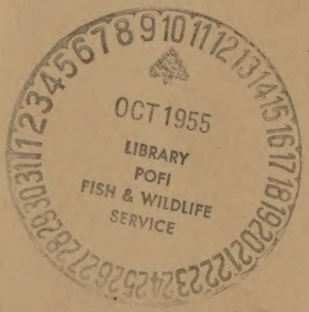
Volume Six

A MONOGRAPH

OF THE CLINGFISHES

(Order Xenopterygii)

By John C. Briggs



Published by the
ATURAL HISTORY MUSEUM OF STANFORD UNIVERSITY
STANFORD, CALIFORNIA, U.S.A.

September, 1955

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September 21, 1955

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This single paper forms Volume 6 complete, and includes 224 pages, 114 figures, 15 maps, 5 dendrograms, and 1 table.

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STANFORD ICHTHYOLOGICAL BULLETIN

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2. *Ginsburg*: Gobiosoma from Lower Calif. *Herre*: Luzoneleotris.
3. *Storey*: Ophichthyid eels. *Myers*: Oral brooding in cichlids. *Myers*: Lienardella. *Myers*: On Notropocharax difficilis.
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VOLUME 6. 224 pages (1955)
(complete in 1 number)

Briggs: Monograph of the clingfishes (Order Xenopterygii). $4.00.

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A MONOGRAPH OF THE CLINGFISHES (ORDER XENOPTERYGII)

By John C. Briggs[1]

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artment of Biology, University of Florida, Gainesville, Florida; for- y Research Associate, Natural History Museum of Stanford University, ford, California.

Gobiesox.....
Acyrtus.....
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EVOLUTION OF THE GOBIESOCIDAE.....
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ZOOGEOGRAPHICAL CONCLUSIONS.....
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Today.....systematics has become one of the focal points of biology. Here we can check our theories concerning selection and gene-spread against concrete instances, find material for innumerable experiments, build up new inductions: the world is our laboratory, evolution itself our guinea-pig.

J. S. Huxley, *The New Systematics*

INTRODUCTION

e clingfishes, forming the family Gobiesocidae and the order Xenop-
ii, are small teleostean fishes provided with a thoracic sucking disc
which they adhere to the substrate. Nearly all occur in shallow
al waters, often in the intertidal zone, where the strong adhesive
atus and the flattened form enable them to maintain position against
ce or sub-surface wave action. Some forms hide among sea-urchins, and
michthys hides among the spines of *Diadema* (Pfaff, 1942). In tropical
ica, species of *Gobiesox* occur rather widely in small, swift, fresh-
coastal streams to which true fresh-water fishes cannot gain access.
, together with *Agonostomus*, and gobies of the genus *Sicydium*, they
a characteristic fauna (Myers, 1949, pp. 319, 322).

ne family is not a large one, but it is widely distributed, occurring
ost warm-temperate and tropical coasts throughout the world. At no
t, however, are the species numerous, and the clingfishes have there-
formed only a small (and neglected) element in any one marine fauna.
last general systematic revision of the group was that of Günther
1), done when relatively few species were known, and subsequent at-
ts at classification have all been on a regional basis, without any
nsive comparison with extralimital forms. Meanwhile, the number of
n species has been greatly increased, and the classification has fallen
confusion.

everal years ago the writer became interested in the clingfishes, and
951 he published a preliminary revision of the Pacific American species,
d chiefly on the somewhat limited material then available in the Natu-
History Museum of Stanford University and the California Academy of
nces. Since that time the Stanford collection has been greatly aug-
ed by material taken on several expeditions, as well as by exchanges
other museums. It has also been possible to borrow much material from
r institutions. Finally, the author has had the opportunity of person-
examining clingfish types in the museums of Europe and Australia.

he research leading to the present monograph was carried on at the Nat-
History Museum of Stanford University, during the time the author was
arch Associate in that Museum. It has been possible to examine materi-
f 92 of the 93 known species belonging to this order. The only one not
is is *Gobiesox woodsi* Schultz. A list of new names proposed is given at
end of the paper.

he drawings were made by the author. Those of the discs are diagram-
ic, and no attempt has been made to show the individual papillae.

Purpose and General Results

he primary purpose of this paper is to work out the inter-relation-
ps—hence the course of evolution—within a well-defined group of fish-
insofar as this is possible by systematic revision of a group in which
sil evidence is not available. A secondary but important goal is to
vide materials of value in marine zoogeography.

As has so often been said, zoogeographical conclusions are no better
n the systematic work on which they are based, and the rapidly growing
d of marine zoogeography is sorely handicapped by the dearth of depend-
e, world-wide systematic revisions of common marine groups. It seems

virtually impossible for a zoologist to work out a true evolutionary pa tern for any group through the examination of only a portion, or even ha or three-quarters, of the existing species. Too many far-reaching concl sions have already been drawn which depend either partly or wholly up mere checklists or local faunal studies unsupported by critical comparis with extralimital forms.

The present monograph is, then, a study of the systematics, in the se understood by Myers (1952), of a group in which the inter-relationships the included genera were very poorly known because most of the systemati dealing with this group has been done on a regional basis.

The systematic work has produced many interesting results. The ord and family prove to be divisible into several distinctive subfamilies, t existence of which had not been suspected. For the first time it becom possible to envision something of the true relationships of any giv genus. Moreover, once the limits of the component groups were establishe there emerged a distributional picture that was not only surprising, b which may be of considerable interest to marine zoogeographers. One them is the presence in South Africa of a genus belonging to the New Wo subfamily Gobiesocinae. Another is the demonstration of the peculia relict nature of the New Zealand gobiesocid genera.

Measurements and Counts

The measurements were made with a pair of fine-point dividers and r corded to the nearest one tenth of a millimeter, or divided into the sta ard length and other body parts.

In these fishes the end of the hypural fan is usually located close the visible base of the caudal rays. This condition can be seen in sma semi-transparent specimens, and verified in larger ones by bending t caudal fin horizontally so that a wrinkle appears at the point where t rays end and the hypural begins. The STANDARD LENGTH is measured from t median anterior edge of the upper lip to the distal end of the hypural fa The terms CAUDAL BASE or MIDCAUDAL BASE also refer to the end of the h pural fan.

The LENGTH OF THE CAUDAL PEDUNCLE is measured from the base of the la anal ray to the midcaudal base. The DEPTH OF THE CAUDAL PEDUNCLE is tak at the least vertical depth. The SNOUT is the distance from the median a terior edge of the upper lip to the anteriormost edge of the external visible eye. The DIAMETER OF THE EYE is the horizontal length of the e ternally visible eye (this measurement is used rather than diameter of bo orbit because the lateral edges of the bony aperture are extremely difficu to locate without dissection in many of the species). The INTERORBIT SPACE refers to the bony interorbital distance, which usually can be iden ified by pressing the dividers against the soft skin on the head. The HE LENGTH is measured from the median anterior edge of the upper lip to t posteriormost edge of the gill membrane. The DISC LENGTH is the long tudinal distance between the outermost edges of the thin membrane surrou ing the heavier portions of the disc. The measurement FROM TIP OF CHIN FRONT OF DISC refers to the space between the median, anteriormost porti of the lower jaw and the anterior membranous edge of the disc.

The RAYS of the DORSAL, ANAL, and VENTRAL FINS are counted anteropos eriorly, and the CAUDAL and PECTORALS dorsoventrally. The number given f the CAUDAL RAYS represents only the principal rays of that fin; i.e. tho usually having noticeably free tips. The LENGTHS of these FINS inclu only the distance between the bases of the first and last rays, omitti

mbrane posterior to the last ray. The measurement referred to as the -CAUDAL is the distance from the dorsal origin to the midcaudal base. rm POSTDORSAL-CAUDAL refers to the distance from the base of the last ray to the mid-caudal base.
some of the genera there may be some very small, degenerate rays ed near the origin either of the dorsal or anal fin, sometimes both. generic description contains a statement regarding the occurrence and r of such rays. The first pectoral ray tends to be very small in all of the genera and is easily overlooked.

Arrangement of Descriptions

e description of each taxon is arranged according to a uniform plan so comparisons may be made more easily. As far as possible, the paras are arranged in uniform order in all descriptions; the discussion tails follows the same sequence. When the description is based upon examination of more than one specimen, the initial values given in the are arithmetic means of all specimens measured; the values included in itheses are the extremes.
ie diagnosis includes the dorsal, anal, pectoral, and caudal ray counts those characters which seem to be of greatest use in distinguishing species concerned from its nearest relatives. These characters are not ated in the body of the description. Generally, for rapid specimen tification, it should be necessary to consult only the keys and this nostic paragraph.
he synonymic lists under each species are not intended to provide a lete catalogue of published references to that species. However, there been an attempt to include those papers which give changes in name or e, as well as the most important reference works.

Acknowledgements

am greatly indebted to several persons for reading portions of the script, and for their many useful suggestions throughout the course of work: Prof. George S. Myers, Norman J. Wilimovsky and Margaret H. ey, Stanford University; Prof. Boyd W. Walker, University of California os Angeles; Prof. Carl L. Hubbs, Scripps Institution of Oceanography; Dr. Leonard P. Schultz, United States National Museum. Especial thanks also due to Miss Storey for her extensive editorial work done in seeing paper through the press. Needless to say, none of these are responsible errors or omissions.
ly Stanford associates materially aided the progress of this study by ir special efforts to collect specimens of this family during field os and expeditions, especially Dr. James E. Böhlke (now at the Academy Natural Sciences of Philadelphia); Dr. Frank S. Cliff (now in the U. S.); Dr. Robert R. Harry (now of the George Vanderbilt Foundation at nford); Daniel M. Cohen, Stanford; Dr. Giles W. Mead (now in the U. S.); Dr. Jay M. Savage (now at Pomona College); and Norman J. Wilimovsky, nford. Also Charles C. G. Chaplin of the Academy of Natural Sciences of adelphia.
Although the clingfish collection at Stanford University is by far the gest in existence, it was necessary to examine many additional specimens

made available through the courtesy of the individuals and institut
listed below: W. I. Follett and Mrs. Lillian Dempster, California Aca
of Sciences; Prof. Boyd W. Walker, University of California at Los Ange
Prof. Carl L. Hubbs, Scripps Institution of Oceanography; Janet Haig,
cock Foundation, University of Southern California; Howard Hill, Los
geles County Museum; Dr. Reeve M. Bailey and Dr. Robert R. Miller, Uni
sity of Michigan; J. T. Nichols, American Museum of Natural History; P
Henry B. Bigelow and Mrs. M. M. Dick, Museum of Comparative Zoology,
vard University; Dr. Leonard P. Schultz and Robert Kanazawa, United St
National Museum; Dr. Luis R. Rivas, University of Miami; Henry W. Fo
and Charles C. G. Chaplin, Academy of Natural Sciences of Philadelp
Loren P. Woods, Chicago Natural History Museum; Antenor L. Carvalho, M
Nacional, Rio de Janeiro; Guillermo F. Mann, Universitaria a Tarap
Chile; Dr. Ethelwyn Trewavas and Denys W. Tucker, British Museum (Nat
History), London; Prof. Leon Bertin, Muséum National d'Histoire Nature
Paris; J. J. Hoedeman, Zoologische Museum, Amsterdam; Dr. M. Boese
Rijksmuseum van Natuurlijke Historie, Leiden; Dr. J. R. Pfaff, Universi
Zoologiske Museum, Copenhagen; G. Belloc, Institut Océanographique de
aco; Dr. Paul Kähsbauer, Naturhistorisches Museum, Vienna; G. E. Maul, M
Municipal do Funchal, Madeira; Dr. Enrico Tortonese, Istituto di Zoolo
Turin; Dr. Delfa Giulia, Museo Civico di Storia Naturale, Genoa; Dr. E
ardo Gridelli, Museo Civico di Storia Naturale, Trieste; K. H. Barn
South African Museum, Capetown; Dr. J. L. B. Smith, Rhodes Univers
Grahamstown; Gilbert P. Whitley, Australian Museum, Sydney; L. D. Crawf
Queen Victoria Museum and Art Gallery, Launceston; R. K. Dell and J
Moreland, Dominion Museum, Wellington; and Dr. Kiyomatsu Matsubara, K
University, Nagahama.

The outline maps, used to illustrate the distribution of the gen
were taken from Goode's Series of Base Maps: World, Continents; and Wo
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Abbreviations of Names of Institutions

The following abbreviations are used in listing specimens under the
counts of species throughout the text.

AM	Zoologisch Museum, Amsterdam, Netherlands
AMNH	American Museum of Natural History, New York, N. Y.
ANSP	Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.
AuM	Australian Museum, Sydney, Australia
BM	British Museum (Natural History), London, England
CAS	California Academy of Sciences, San Francisco, Calif.
CNHM	Chicago Natural History Museum, Chicago, Ill.
DM	Dominion Museum, Wellington, New Zealand
GM	Museo Civico di Storia Naturale, Genoa, Italy
HF	Allan Hancock Foundation, University of Southern California, Los Angeles, Calif.
IOM	Institut Océanographique de Monaco, Monaco
KU	Kyoto University, Nagahama, Japan
KZM	Universitets Zoologiske Museum, Copenhagen, Denmark
LACM	Los Angeles County Museum, Los Angeles, Calif.
LM	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Mas
MMF	Museu Municipal do Funchal, Madeira
MN	Museu Nacional, Rio de Janeiro, Brazil
MHNP	Muséum National d'Histoire Naturelle, Paris, France

stituto di Zoologia, Turin, Italy
laturhistorisches Museum, Vienna, Austria
Queen Victoria Museum and Art Gallery, Launceston, Tasmania
Rhodes University, Grahamstown, South Africa
South African Museum, Capetown, South Africa
Scripps Institution of Oceanography, University of California, La Jolla, Calif.
Natural History Museum of Stanford University, Stanford, Calif.
Museo Civico di Storia Naturale, Trieste, Italy
University of California at Los Angeles, Calif.
University of Miami, Miami, Florida
University of Michigan Museum of Zoology, Ann Arbor, Mich.
United States National Museum, Washington, D. C.
Universitaria a Tarapacá, Tarapacá, Chile

Order XENOPTERYGII

ERYGII Gill, 1885, p. 267 (suborder); 1893, p. 137 (suborder).—Jordan and Evermann, 1898, p. 2826 (suborder).—Regan, 1913b, p. 111 (order); 1929 (order).—Jordan, 1923, p. 238 (order).
ERI Boulenger, 1904, p. 708 (suborder).—Regan, 1909, p. 81 (order).
OCOMORPHI Hay, 1929, p. 797 (order).
SOCIFORMES Goodrich, 1930, p. xx ("division").—Berg, 1940, p. 341 (order).—Schultz and Stern, 1948, p. 247 (order).
OCIDA Briggs, 1951, p. 61 (order).

ll (1885, and in Jordan and Evermann, 1898), Boulenger (1904), and (1909; 1929) have defined and characterized this order. It is to authors and to Starks (1905) that we owe what is known of the ordinal tionships. Starks studied the osteology of *Gobiesox* (*"Caularchus"*) and l (1889) made an intensive and beautifully illustrated investigation e entire morphology and development of *Lepadogaster*.
is now generally conceded that the clingfishes deserve recognition as tinct order. In addition to the adhesive disc with its unique arment of bony disc supports, there are other notable characteristics. te obvious percomorph relationships, there is no vestige of a spinous l fin. The skull is flattened and somewhat simplified through the of several bones found in less specialized teleosts. Other cranial have become considerably modified in form and position. The postal osteology is also distinctive.
e Xenopterygii seem to be most closely allied to the Haplodoci (batras) but there is also some resemblance to the Callionymoidei. The may be considered a highly specialized derivative of some still unprimitive percomorph stock.
e characters common to all of the species are given in the family iption.

FAMILY GOBIESOCIDAE

SOCIOIDEI, Bleeker, 1860, p. 55.
SOCIDAE, Günther, 1861, p. 489.

ingfishes range in size from 16.7 mm. to about 300 mm. standard length. ough a great variety of body shapes occurs among the species, the ante-

rior part of the head is always more or less depressed. The lateral l is present with the pores well developed on the head but small and dif cult to locate posteriorly. There are no scales; a heavy coat of mucus exuded which becomes hardened on the body when the specimen is placed preservative. It is often helpful to scrape some of this material away fore attempting to count the fin rays. The anterior nostril is always bular and the posterior nostril usually so.

There is one dorsal and one anal fin; the ventral fins are incorpora into a prominent adhesive disc, located on the ventral body surface direc below the junction of the head and body. The four rays of each ventral form the lateral edges of the disc with the last ray having a membran attachment to the lower portion of the pectoral base. Posterior to ventral rays, the free edge of the disc extends dorsally behind the pecto fin to form an axial dermal flap.

Certain parts of the ventral surface of the disc bear small, flatten dermal papillae which presumably are of use in the adhesive function. numbers and patterns of these papillae vary considerably from genus genus, and form useful generic and sometimes specific characters. For scriptive purposes the surface of the disc is divided into three differ areas (fig. 1): region A is the anterior portion; region B the posteri and region C the central. The discs are of two basic types: the "doub variety has a small, posterior disc with a free anterior edge separating from the front portion; in the "single" type the two parts have bec coalesced into one continuous structure.

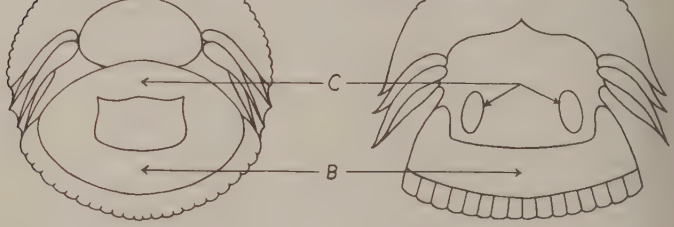


Fig. 1. Diagrams illustrating disc regions in a double type disc (le *Lepadogaster*) and a single type disc (right, *Gobiesox*), and showing three regions of the disc (A, B, and C) referred to in the descriptions.

The urogenital papilla, just behind the anus, is not only larger in males of many clingfishes, but may be generically characteristic.

The size, shape, and position of the teeth in the jaws are highly var ble but form useful systematic characters at the generic and speci levels. Pharyngeal teeth occur in three areas: two small, round patches the roof of the pharynx; and one V-shaped cluster on the pharynx floor. dorsal areas are supported by the pharyngobranchial elements of the sec and third or (usually) the third and fourth branchial arches. The vent area extends from the surface of the fifth branchial arch.

Some of the skull bones have been lost. The lachrimal is usually pr ent, but the rest of the suborbital series is missing; the entopterygo and metapterygoid are also absent. A fenestra can be seen between preoperculum and the quadrate. The post-temporal is long, slender, and forked; it articulates with a slender, rodlike supracleithrum. There i

ranch (not present in the genus *Gouania*) and three or three and one-
.lls; the gill rakers are absent in one genus (*Liobranchia*) but vary
er and in shape in the others. There are five to seven, usually six,
ostegal rays."
h pectoral and pelvic bones have become highly modified for the
t of the disc. Posteriorly, two large bones, identified as parts of
stcleithrum by Starks (1905, p. 298), accomplish this purpose. A
mal" postcleithrum extends ventrally either from the scapula or part
cleithrum and forms the base of the prominent axial flap behind the
al fin. A "distal" postcleithrum lies on each side of the posterior
f the disc between the end of the proximal postcleithrum and the mid-
ine. Anteriorly, the cleithrum extends forward and curves under the
part of the disc. The two cleithra are connected at the symphysis.
pelvis is an elongate, wedge-shaped structure, lying horizontally,
under the mid-anterior part of the disc, with its short side against
teriormost part of the cleithrum. A small, Y-shaped bone which orig-
just in front of the first ventral ray is present on each side of the
(fig. 2). This bone is possibly a highly modified spine, since
found in a location where one might expect a spine to occur (earlier
s have identified it as such). However, neither its shape nor its
on is spine-like, and there is some possibility that it is actually a

. 2. Outline of the pelvis of *Gobiesox maeandricus* showing attach-
f the "modified spine" and the four ventral fin rays.

racoid (although this bone is known so far only from the most primi-
eleost groups). The pelvis, therefore, mainly supports the middle
or portion of the disc as well as that part of the periphery which
ts of the four ventral rays. In addition, the posterior end of the
wedge is sometimes enlarged and articulates directly with the two
postcleithral bones; when this is not true there is probably a
aginous connection between these parts.
ribs are absent and are replaced by sessile epipleurals. There are
nes in the median fins, and the rays of all fins are unbranched. The
rae vary from 25-54.
re are eight subfamilies, 33 genera and 93 species. The distribution
mopolitan in temperate and tropical waters. Apparently all of the
s are marine except for four members of the genus *Gobiesox*. A single
form, *Bulbiceps raninus* Jordan, 1919b, p. 5, pl. 6 (Miocene? Soledad,
rnia), has been described but, unfortunately, there is considerable
that the fossil belongs to this order. Examination of the plate
no characters enabling one to speculate upon systematic position.
pe, at Stanford, was packed away and was not examined.

SYNOPSIS OF THE SUBFAMILIES

1a. Gills three and one-half.
 2a. Gill membranes free from isthmus.
  3a. Disc double (*Indo-Pacific to Japan*).....TRACHELOCHISMINAE (p.
  3b. Disc single (*New Zealand*).....HAPLOCYLICINAE (p.
 2b. Gill membranes attached to isthmus.
  4a. Disc double (*ALL Eastern Atlantic Species Plus One in South Afric*
  .....LEPADOGASTRINAE (p.
  4b. Disc single (*South Africa*).....CHORISOCHISMINAE (p.
1b. Gills three.
 5a. Gill membranes free from isthmus.
  6a. Disc double (*South Africa to Indo-Pacific*).....DIPLOCREPINAE (p.
  6b. Disc single (*ALL New World Species Plus One in South Africa*).....
  .....GOBIESOCINAE (p.
 5b. Gill membranes attached to isthmus.
  7a. Disc double (*Indo-Pacific to Japan*).....ASPASMINAE (p.
  7b. Disc single (*South Africa to Indo-Pacific*).....
  .....DIADEMICHTHYINAE (p.

Subfamily TRACHELOCHISMINAE, new

Gills three and one-half; gill membranes united and free from isthm disc double. There are five genera and seven species; they are found the Indo-Pacific from New Zealand to Japan.

ARTIFICIAL KEY TO THE GENERA OF TRACHELOCHISMINAE

1a. Body very long and narrow with about 54 vertebrae; disc small, len 8.3 in standard length; 4 dorsal rays.....*Gastrocymba* (p.
1b. Body comparatively short and broad with 31-33 vertebrae; disc larg length 2.8-4.0 in standard length; 7-11 dorsal rays.
 2a. A large, strong subopercular spine present; a well-developed, fle pad with a free posterior margin on lower pectoral base; disc len 2.8-3.0 in standard length.....*Creocele* (p.
 2b. No spine in subopercular region; if a fleshy pad is present it weakly developed, without a free posterior margin; disc length 3.1- in standard length.
  3a. Fourteen rakers on second gill arch; subopercular bone absent; dis postcleithral bones distinctive (fig. 44).....*Dellichthys* (p.
  3b. Six to 8 rakers on second gill arch; subopercular bone present; d tal postcleithral bones different (figs. 45, 46).
   4a. A shallow, fleshy swelling at lowest part of pectoral base; l moderately broad; posterior end of pelvis extends between the distal postcleithral bones (fig. 45).....*Conidens* (p.
   4b. No fleshy swelling at lowest part of pectoral base; lips very br and fleshy; posterior end of pelvis does not reach the two dis postcleithral bones (fig. 46).....*Trachelochismus* (p.

Genus *GASTROCYMBA*, new

Figure 14; Map 2

pe species: *Diplocrepis 4-radiatus* Rendahl, 1925.

dy extremely attenuate, compressed posteriorly and rounded anteriorly. comparatively small, well depressed and somewhat triangular in shape a dorsal view. Upper lip fairly broad, retrorse, a little wider at f snout than at sides.

deep patch of sharp, conical teeth at front of each jaw, those in the row the largest. These reduced to a single row of recurved teeth at of jaws. Five short, blunt rakers on second gill arch. Edges of gill anes attached well in front of pectoral base and below upper origin of ral fin. No fleshy swelling or pad on lowest part of pectoral base.

rsal and anal fins both very short. Pectoral fin fairly well devel- with a moderate number of rays. Median fin rays easily counted, irst pectoral ray quite small and may be overlooked. Disc very small ounded; from a ventral view the external structure is characteristic 14).

parently the subopercular element is present. There is no spine in region. Unfortunately, there was but a single specimen of the one es in this genus available for study, so it was not desirable to sub- it to the clearing and staining process. Therefore, nothing is known the pelvis and distal postcleithral bones. X-ray photographs did not these parts with sufficient clarity. However, it was possible to ob- a fairly accurate vertebral count by this method. It was found that a of 54 vertebrae were present, far more than has been recorded for any genus of clingfishes. The number of branchiostegals could not be mined.

is is a monotypic genus confined to New Zealand waters. The name is the Greek *gaster*, stomach or belly; and *kumbos*, a cup.

Gastrocymba quadriradiata (Rendahl)

crepis 4-radiatus Rendahl, 1925, p. 8 (Port Ross, Auckland Islands).

AGNOSIS: A slender, extremely elongate clingfish with a very long l peduncle. Dorsal and anal fins very small. Dorsal rays 4, anal 4, pectoral rays 24, and caudal rays 8.

SCRIPTION: Body slender, subcylindrical anteriorly, depth 9.8 in stand- length. Depth of caudal peduncle 7.9 in its length. Anus located tly closer to rear margin of disc than to origin of anal fin. Head and well depressed anteriorly, length 4.4 and width 6.8 in standard h. Snout long and broadly rounded at the tip, 3.4 in head. Anterior il with a very small, simple dermal flap extending from its posterior n; posterior nostril directly above anterior edge of eye. Eye 1.2 in interorbital space and 4.7 in head.

pper attachment of gill membrane opposite 5th pectoral ray. Upper hment of axial dermal flap opposite 18th pectoral ray. Postdorsal- l distance in dorsal fin length 0.2; dorsal-caudal distance extended rd reaches to a point behind tip of pectoral fin. Disc small, length n standard length; no flattened papillae present in central portion sc region A; disc region B with 3 rows of flattened papillae across idth; no papillae in central portion of disc region C. Maximum known 71.0 mm. standard length.

LORATION: All coloration has been lost from the single specimen avail-

able for study. In the original description Rendahl (1925, p. 8) gave color in spirits as reddish brown.

RELATIONSHIP: A peculiar species with no known close relatives.

MATERIAL EXAMINED: DM (not numbered); one specimen from Perseverе Harbour, New Zealand.

RANGE: Auckland Islands to Perseverance Harbour, New Zealand.

Genus *CREOCELE*, new

Figures 15, 43; Map 1

Type species: *Gobiesox cardinalis* Ramsay, 1882.

Body broad and well depressed anteriorly: head large and very bro also well depressed. Snout short, rounded and scarcely produced in dor outline. Mouth large; upper lip very narrow and short. Nostrils on e side well separated and distinctly tubular.

Both jaws with a deep patch of blunt, conical teeth at the front, th becoming reduced to a single row along sides. Seven short, blunt rak present on second gill arch. Edges of gill membranes attached latera close to pectoral base and below upper origin of pectoral fin. A promin fleshy pad is present on the lower pectoral base.

Dorsal fin medium in size, anal comparatively short. The first ray the dorsal, anal, and pectoral fins very small and apt to be overloo when counts are made. Disc very large and rounded with a distinctive p tern of flattened papillae on ventral surface (fig. 15).

Subopercular element present and forms the terminal bone posteriorly side of head. It bears a large, strong spine. Pelvis and especially distal postcleithral bones are characteristic in shape from a ventral v (fig. 43). Pelvis somewhat similar to that found in the New Zealand ge *Diplocrepis* of the subfamily Diplocrepinae. There are 33 vertebrae, an or 7 branchiostegals.

There is no externally apparent sexual dimorphism.

This is a monotypic genus, apparently confined to Tasmania. The name from the Greek *kreas*, flesh; and *kele*, a swelling, in reference to swollen, fleshy pad on the lower pectoral base.

Creocele cardinalis (Ramsay)

Gobiesox cardinalis Ramsay, 1882, p. 148 (George Town, Tasmania).
Diplocrepis cardinalis Waite, 1906, pl. 36, fig. 2 (Launceston and Ulv stone, Tasmania).—McCulloch, 1929, p. 360 (Tasmania).
Volčiolus cardinalis Whitley, 1935, p. 292.—Scott, 1936, p. 123 (Geo Town, Low Head and Ulverstone, Tasmania).

DIAGNOSIS: A large, broad, clingfish with a prominent fleshy pad lower pectoral base. The free posterior margin of this structure exte dorsally to the 17th (16-17) pectoral ray. Dorsal rays 9 (9-10), anal r 7 (6-7), pectoral rays 25 (24-25), and caudal rays 11 (10-12).

DESCRIPTION: Body broad and well depressed, depth 5.4 (4.9-6.0) in sta ard length. Caudal peduncle short, depth 1.0 (0.9-1.1) in its leng Anus located much closer to rear margin of disc than to anal fin orig Head broad and well depressed, length 2.4 (2.3-2.5) and width 2.6 (2.5-2 in standard length. Snout in dorsal outline broad and rounded, 3.2 (3 3.3) in head. Anterior nostril with a large, simple, dermal flap whi

n depressed backward, reaches the posterior nostril; posterior nostril ated directly above anterior edge of eye. Eye 1.3 (1.1-1.6) in bony erorbital space and 5.5 (4.7-6.0) in head.

Upper attachment of gill membrane opposite 4th (3-5) pectoral ray. er attachment of axial dermal flap opposite 10th (8-12) pectoral ray. tdorsal-caudal distance in dorsal length 1.2 (1.0-1.3); dorsal-caudal tance measured forward extends to tip of pectoral fin or behind this nt. Disc length 2.9 (2.8-3.0) in standard length; disc region A with 4-5) rows of flattened papillae across its width; disc region B with 4-5) rows across its width; 3 (3-4) rows across width of disc region C. imum known size 66.3 mm. standard length.

COLORATION: The preserved specimens examined were all badly faded. Forıately, Scott (1936, p. 123) has given an excellent description of the e colors of two topotypes.

"General ground colour pale translucent green; ventral surface white h a tinge of green, except on tail, which is concolorous with sides and k. Dorsal surface, which behind the head exhibits a distinct purplish ffusion underlying the green, abundantly punctulated throughout, and otted and marbled with dark greenish. Sides marked in posterior half th spots, lighter than the ground colour, that tend to form two or three ngitudinal rows, those of the lowest row the largest. Three or four scure dark green vertical bands on the body, about as wide as their interaces, extending about halfway down the sides. Head in general concolors with body. Purple lozenge on nape. Purplish tinge on dorsal surface snout, with definite narial spots of purple. Extending downwards and rwards from antero-inferior border of eye a clear unpunctulated region of le green, subtriangular, widest inferiorly, bounded behind by a wellfined subvertical dark green band. Iris green; dark blue pupil with rrow annulus of dark orange. Ventral surface in advance of sucker in neral immaculate, though the punctulations of the sides extend slightly yond inferior profile of body, and there are also present two forwardly nverging bands of punctulations visible only with a lens; behind sucker th the smaller, but without the larger, spots of sides and back. Adhesive paratus immaculate, whitish, becoming pinkish centrally. Vertical fins re or less greenish, the dorsal with a purplish spot in its upper anterior lf, the anal with some purplish, especially near its middle, the caudal th a vertical band of purplish distally. Pectorals greenish, thickly nctulated with darker. Pelvics white, with a hint of green distally; a w small dark spots, mostly placed proximally.

"A second specimen, 25 mm. in total length, collected at the same time, generally similar in coloration, but exhibits the following variations: udal with three vertical bars of purplish, the anterior one extending on the caudal peduncle; dorsal and anal fins, when depressed, are seen to crossed by distinct brownish purple bands, three on dorsal, two on anal; rplish tinge on dorsal surface of body more decided, and extending furer caudad; purple lozenge on nape less conspicuous; clear triangular subbital region less clearly defined, being to some extent encroached on by nctulations."

RELATIONSHIP: A primitive, relict species evidently now confined to smania. No close relatives are known.

MATERIAL EXAMINED: AuM 1A7956; one specimen from Cox's Bight, South stern Tasmania. AuM A6793-A6795; three (syntypes of *Gobiesox cardinalis*), om near George Town, Tasmania. SU 47668; 47671; six, from Low Head, Tasnia. SU 47670; one, from Burnie Reef, far end of East Beach, Tasmania. M 1A3546; one, from Wynyard, Tasmania. SU 47669; five, from Stanley.

RANGE: Tasmania, from Cox's Bight in the South West, north to Stanley.

Genus *DELLICHTHYS*, new

Figures 16, 44; Map 2

Type species: *Dellichthys morelandi*, new species.

Body medium in width and depressed anteriorly; head medium and depress with a protruding, spatulate snout. Nostrils on each side well separat and distinctly tubular. Upper lip narrow, separated by a broad frenum tip of snout. Teeth small, sharp, conical, occurring in deep patches t ward the front of each jaw, these reduced to a single row of larger, r curved, canine-like teeth along sides of jaws. Fourteen long, narro pointed rakers on second gill arch. Edges of the gill membranes attach laterally slightly in front of, and a little below, upper origin of pector fin. A small, fleshy swelling present on lowest part of pectoral base b never a well-developed pad.

All fins of medium length. Ray counts of median fins can be taken rea ily, but the first pectoral ray very small and apt to be overlooked. Di is medium in size, and rounded. The pattern of flattened papillae on t ventral disc surface (fig. 16) is characteristic for the New Zealand are but very similar to that found in the Eastern Atlantic genera *Lepadogast* (fig. 21), *Diplecogaster*, *Apletodon*, and *Gouania*.

Subopercular element missing, the opercle forming the terminal bo posteriorly on side of head. It is without a spine. Both pelvis and t distal postcleithral bones have a characteristic shape from a ventral vi (fig. 44). There are 32 vertebrae, and 6 branchiostegals.

There is no externally apparent sexual dimorphism.

This is a monotypic genus confined to New Zealand. It is named for D R. K. Dell of the Dominion Museum, Wellington, in recognition of his i terest in the shore fishes of New Zealand and his generosity in providi material of great value for use in this monograph.

Dellichthys morelandi, new species

Figure 82

DIAGNOSIS: A medium sized clingfish with a distinctive spatulate snou and with upper attachment of gill membrane opposite 2nd (2-3) pectoral ra Dorsal rays 9 (8-9), anal rays 8 (8-9), pectoral rays 22 (21-23), and ca dal rays 11 (10-12).

DESCRIPTION: Body medium in width and well depressed anteriorly, dep 6.3 (6.0-6.5) in standard length. Caudal peduncle medium, depth 1.2 (1. 1.5) in its length. Anus located closer to origin of anal fin than to re margin of disc. Head medium and well depressed, length 2.4 (2.3-2.4) a width 4.1 (3.8-4.3) in standard length. Snout narrow and protruding dorsal outline, 3.2 (3.0-3.3) in head. Anterior nostril with a simpl narrow, dermal flap extending from its posterior margin; posterior nostr behind anterior edge of eye. Eye 0.6 (0.5-0.8) in bony interorbital spa and 5.1 (4.5-6.0) in head.

A small, poorly developed, fleshy pad present on lowest part of out pectoral base. Upper attachment of axial dermal flap opposite 11th (10-1 pectoral ray. Postdorsal-caudal distance 1.4 (1.2-1.6) in dorsal lengt dorsal-caudal distance measured forward extends to tip of pectoral fin just behind this structure. Disc length 3.8 (3.6-4.0) in standard lengt disc region A with 5 (3-6) rows of flattened papillae across its widt disc region B with 6 (5-6) rows across its width; 4 (4-5) rows acro width of disc region C.

COLORATION: The alcohol specimens had lost all coloration.

RELATIONSHIP: An interesting species with no known close relatives.
HOLOTYPE: Dominion Museum, Wellington, number 1574; 42.4 mm. in standard gth, collected by R. K. Dell and J. M. Moreland, at Lottin Point, New land, on December 5, 1950.
PARATYPES: DM 1575; four specimens, 28.2 to 37.5 mm. in standard length, en with the holotype. SU 47672; four, 16.3 to 38.4 mm. in standard gth, collected by R. K. Dell, at Lyall Bay, Wellington, New Zealand, January 1, 1950. AuM I 14847; four, 36.8 to 46.3 mm. in standard gth, collected at Otatu Island beach, Auckland, New Zealand, on January 1919.
DERIVATION OF NAME: This form is named for Mr. J. M. Moreland of the inion Museum, Wellington, New Zealand, in gratitude for the loan of cimens which he helped collect, and because of his interest in the shore hes of New Zealand.

Genus *CONIDENS*, new

Figures 17, 45; Map 1

Type species: *Crepidogaster samoensis* Steindachner, 1906.
Body medium in width and depressed anteriorly; head comparatively slen- with a short, rounded snout somewhat produced in dorsal outline. Head gth 2.3-2.6 and width 3.3-3.9 in standard length. Nostrils on each side l separated and distinctly tubular. Upper lip fairly broad, retrorse, a tle wider at sides of snout than at front.
Patches of small, conical teeth toward front of each jaw; these reduced a single row of larger, recurved teeth along sides of jaws. Seven row, pointed rakers on second gill arch. Edges of gill membranes at- hed laterally close to pectoral base and a little below upper origin of toral fin. A poorly developed, fleshy pad present on lowest portion of toral base.
Median fins comparatively short; dorsal rays 8-9, anal rays 5-8, and dal rays 10-13. Pectoral rays vary from 20-22. Usually the dorsal and al ray counts can be taken readily, but the first pectoral ray is very all and may be overlooked. External structure of disc (fig. 17) though distinctive, aids in generic identification. Subopercular element sent and is the terminal bone posteriorly on side of head. It has no ine. Both pelvis and the distal postcleithral bones characteristic in pe (fig. 45). There are 31 vertebrae, and 6 branchiostegals.
In life, apparently one species, *C. samoensis*, is always light colored ile the other, *C. laticephalus*, is very dark.
There seems to be no externally apparent sexual dimorphism.
The two known species range from the Indo-Pacific to Japan. The name is m the Latin *conus*, a cone; *dens, dentis*, a tooth, in reference to the nical teeth in this genus.

Artificial Key to the Species of *Conidens*

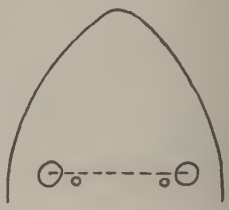
. Color very light, may be reddish or yellowish; gill rakers narrow and pointed; the head pore close to each posterior nostril lies on or slightly in front of a hypothetical line drawn between the centers of the two posterior nostrils (fig. 3).....*samoensis* (p. 16)
. Color very dark, usually blackish; gill rakers short and blunt; the head pore close to each posterior nostril lies behind a hypothetical line drawn between the centers of the two posterior nostrils (fig. 4).. .....*laticephalus* (p. 17)

Conidens samoensis (Steindachner)

Figure 3

Trachelochismus pinnulatus Günther (*non* Forster), 1861, p. 510 (Fiji I lands). —Kner (*non* Forster), 1868, p. 347 (Kanathia, Fiji Islands —Schmeltz (*non* Forster), 1869, p. 21 (Samoa); 1874, p. 31 (Viti I lands). —Günther (*non* Forster), 1881, p. 223 (Oualan, Fiji Islands
Crepidogaster samoensis Steindachner 1906, p. 1408 (Upolu, Samoa).
Aspasmogaster oro Jordan (*nomen nudum*), 1927, p. 10 (Samoa).
Aspasmogaster samoensis Schultz, 1943, p. 289 (Fagasa Bay, Tutuila Islan Samoa).

DIAGNOSIS: A small *Conidens* which quickly loses all coloration alcohol. The head pore close to each posterior nostril lies on or slight in front of a hypothetical line drawn between the centers of the two pos erior nostrils (fig. 3). Dorsal rays 9, anal rays 7 (6-8), pectoral ra 21 (20-22), and caudal rays 11 (10-12).



Figs. 3 and 4. Position of head pores in relation to the posteri nostrils. Fig. 3. *Conidens samoensis*. Fig. 4. *Conidens laticephalus*.

DESCRIPTION: Body of medium width, fairly well depressed anteriorly depth 5.9 (5.7-6.0) in standard length. Caudal peduncle short, depth 0. (0.8-1.1) in its length. Anus much closer to origin of anal fin than t rear margin of disc. Head medium and well depressed, length 2.4 (2.3-2. and width 3.7 (3.3-3.9) in standard length. Snout somewhat protruding dorsal outline, 3.5 (3.1-3.9) in head. Anterior nostril with a long, na row, simple dermal flap which, when depressed backward, usually reaches t posterior nostril; posterior nostril located above or just behind anteri edge of eye. Eye 0.7 (0.6-0.8) in bony interorbital space and 4.1 (3.9 4.3) in head.

Upper attachment of gill membrane opposite 3rd (2-4) pectoral ray. slight swelling present on lowest portion of outer pectoral base, but n well-developed fleshy pad. Upper attachment of axial dermal flap opposi 13th (12-14) ray. Postdorsal-caudal distance in dorsal length 1.6 (1.3 1.8); dorsal-caudal distance measured forward extends as far as the dist one-third of pectoral fin or may not quite reach tip. Disc length 3. (3.2-3.7) in standard length; disc region A with 5 (4-5) rows of flatten papillae across its width; disc region B with 7 (6-8) rows across it width; 5 rows across width of disc region C. Maximum known size 20.7 m standard length.

COLORATION: No distinctive coloration could be found in the alcoh

mens. In the original description, Steindachner (1906, p. 1408) told ne sides of the body being carmine red with the dorsal and anal fins what darker. He also said the ventral side of the body was a reddish ow and that a yellow line was sometimes present on the top of the head een the posterior parts of the eyes.

ELATIONSHIP: Close to *C. laticephalus* but differing markedly in color, in the position of some of the head pores.

ATERIAL EXAMINED: AuM 1A5989; one specimen from Nouméa, New Caledonia. 7686; one, also from Nouméa. AuM 1A831; one, from Vila Harbour, New ides. USNM 115403; one, from Fagasa Bay, Tutuila Island, Samoa.

ANGE: New Caledonia, New Hebrides, Fiji Islands, and north to Samoa.

Conidens laticephalus (Tanaka)

Figure 4

sma laticephala Tanaka, 1909, p. 25 (Kodzushima, Islands of Idzu, Japan). —Jordan, Tanaka, and Snyder, 1913, p. 378 (Kodzushima). —Okada, Uchida, and Matsubara, 1935, p. 249, pl. 148. —Okada and Matsubara, 1938, p. 378. —Okada, 1938, p. 249 (Honsyu, Japan).

IAGNOSIS: A comparatively large *Conidens* which is very heavily pig- ed and retains much of its dark color in alcohol. The head pore close ach posterior nostril lies behind a hypothetical line drawn between the ers of the two posterior nostrils (fig. 4). Dorsal rays 8 (8-9), anal 6 (5-7), pectoral rays 20, and caudal rays 12 (11-13).

ESCRIPTION: Body of medium width and fairly well depressed anteriorly, h 6.2 (6.0-6.3) in standard length. Caudal peduncle short, depth 1.0 -1.1) in its length. Anus located much closer to origin of anal fin to rear margin of disc. Head medium and well depressed, length 2.5 -2.6) and width 3.5 (3.3-3.8) in standard length. Snout somewhat pro- ling in dorsal outline, 3.4 (3.1-3.5) in head. Anterior nostril with a der, simple, dermal flap which, when depressed backward usually reaches terior nostril; posterior nostril located just behind anterior edge of . Eye 0.8 in bony interorbital space and 4.5 (4.3-4.9) in head. Upper attachment of gill membrane opposite 3rd (2-4) pectoral ray. A ght swelling present on lowest portion of outer pectoral base, but no l-developed fleshy pad. Upper attachment of axial dermal flap opposite h (11-12) pectoral ray. Postdorsal-caudal distance in dorsal length (1.3-1.7); dorsal-caudal distance measured forward extends to distal -third of pectoral fin. Disc length 3.2 (3.1-3.3) in standard length; c region A with 4 (3-4) rows of flattened papillae across its width; c region B with 6 (5-7) rows across its width; 5 rows across disc region Maximum known size 33.0 mm. standard length.

COLORATION: In alcohol, the dorsal surface of the body, the sides, and median fins are all very blackish. There is a narrow, non-pigmented der on the caudal and anal fins. The ventral part of the body and the face of the disc are lighter, although many melanophores are still pres- . Okada, Uchida, and Matsubara (1935, pl. 148) show a colored photograph a fresh specimen in which the body is a uniform, dark, blackish brown.

RELATIONSHIP: Close to *C. samoensis*, but differing considerably in color- on and in the placement of the head pores.

MATERIAL EXAMINED: SU 47685; one specimen from Hayama, Kanagawa, Japan. Z 162002; two, from Misaki, Kanagawa, Japan. SU 47684; one, from Komi- o, Chiba, Japan.

RANGE: Kozushima, Izu shichito Islands to Sagami Nada, Kanagawa, Japan.

Genus *TRACHELOCHISMUS* Brisout de Barneville

Figure 46; Map 2

Trachelochismus Brisout de Barneville, 1846c, p. 212 (type species *Cyclo terus pinnulatus* Forster, 1844, by monotypy).

Oliverichtus Whitley and Phillipps, 1939, p. 236, pl. 22, fig. 5, 6 (ty species *Trachelochismus melobesia* Phillipps, 1927, by original desi nation).

Body moderately depressed anteriorly; head broad and somewhat triangul in dorsal outline, the snout more produced in *T. melobesia* than in T. *pin latus*. Head well depressed, length 2.3-2.5 and width 2.8-3.4 in standa length. Nostrils on each side well separated and distinctly tubular. U per lip large, fleshy, retrorse; widest at sides of snout.

Teeth small, conical, recurved, in deep patches toward front of each ja These become narrowed to a single row along sides of jaws, larger than tho found at front. Six to 8 narrow, pointed rakers on second gill arch. Edg of gill membranes attached laterally close to pectoral base, a little pos erior to upper origin of this fin. No fleshy pad on lower pectoral base.

Median fins comparatively short; dorsal rays 7-11, anal rays 5-8, a caudal rays 11-12. Pectoral rays vary from 22-26. Usually, the dorsal a anal ray counts can be taken readily, but first pectoral ray is very sma and apt to be overlooked. Disc fairly large, length 3.2-3.5 in standa length. The external structure of the disc is of considerable interes since, in contrast to most other genera, there is a marked specific diffe ence in *Trachelochismus* in the pattern of the flattened papillae on the ve tral surface. None of these papillae are found in the central portion disc region A in *T. pinnulatus* (fig. 18) while they are present in *T. mel besia* (fig. 19).

Subopercular element present and is the terminal bone posteriorly on si of head. It has no spine. Both pelvis and distal postcleithral bones ha a characteristic shape from a ventral view (fig. 46). There are no specif differences in these bony disc supports. There are 31-33 vertebrae. T branchiostegals vary from 6 to 7 in *T. melobesia* while the standard numb of 6 was found in *T. pinnulatus*.

As in most other genera, the life colors seem to be highly variable a are probably not reliable for taxonomic purposes.

There is no externally apparent sexual dimorphism. Graham (1953, p. 37 mentioned that the males are always smaller than the females (presumably reference to sexually mature fish).

There are but two known species in this genus, both confined to N Zealand Waters.

Artificial Key to the Species of *Trachelochismus*

1a. Dorsal-caudal distance measured forward extends to a point behind ti of pectoral fin; postdorsal-caudal distance 1.2 (1.1-1.4) in dorsa length; no flattened papillae in central part of disc region A (fig 14.....*pinnulatus* (p. 1

1b. Dorsal-caudal distance measured forward extends to proximal one-half pectoral fin; postdorsal-caudal distance 1.9 (1.8-2.1) in dorsal length flattened papillae present in central part of disc region A (fig. 19). .....*melobesia* (p. 2

Trachelochismus pinnulatus (Forster)

Figure 18

...logaster pinnulatus Forster *in:* Bloch and Schneider, 1801, p. 2 (Novae Zeelandae).

...opterus pinnulatus Forster, 1844, p. 301 (Aestuaria Reginae Charlottae).

...helochismus pinnulatus Brisout de Barneville, 1846c, p. 212 (New Zealand).—Hutton, 1872, p. 40 (New Zealand).—Sherrin, 1886, p. 303 (New Zealand).—Gill, 1893b, p. 101 (Queen Charlotte Sound, New Zealand).—Rendahl, 1925, p. 8 (Wellington Harbour; North Channel, Kawaii Island, Hauraki Gulf).—Fowler, 1928, p. 447 (New Zealand, Polynesia).—Whitley, 1950, p. 127, fig. (Queen Charlotte Sound, New Zealand); 1951, p. 404, fig. 11 (Queen Charlotte Sound, New Zealand).—Graham, 1953, p. 370, fig. (Harrington Point, Otago Heads; Seal Point, south of Otago Heads; Manukau Harbour, Week's Island; Opape).

...helochismus guttulatus Hutton, 1872, p. 41 (New Zealand).—Sherrin, 1886, p. 303 (New Zealand).

...smogaster simus Hutton, 1896, p. 316 (Lyttelton Harbour and Chatham Islands).

...idogaster simus Regan, 1914, p. 21.

...ocrepis tumidus Griffin, 1928, p. 385, pl. 64, fig. 9 (Ponui Island, Auckland Harbour).

DIAGNOSIS: A large *Trachelochismus* with comparatively short dorsal and ... fins. Dorsal-caudal distance measured forward extends to a point be... tip of pectoral fin; postdorsal-caudal distance 1.2 (1.1-1.4) in dor... length. Dorsal rays 8 (7-9), anal rays 6 (5-7), pectoral rays 25 (24-... and caudal rays 12 (11-12).

DESCRIPTION: Body of medium width and well depressed anteriorly, depth ... (4.7-5.4) in standard length. Caudal peduncle short, depth 1.0 (0.9-...) in its length. Position of the anus somewhat variable; it may lie ...f-way between rear margin of disc and origin of anal fin or a little ...ser to one or the other. Head large and well depressed, length 2.3 (2.3-...) and width 3.0 (2.8-3.4) in standard length. Snout short and broad ...dorsal outline, 3.4 (3.2-3.7) in head. Anterior nostril with a broad, ...ple, dermal flap extending from its posterior margin; posterior nostril ...ally above or just in front of anterior edge of eye. Eye 1.3 (0.9-1.8) ...bony interorbital space and 5.5 (4.8-6.9) in head.

Upper attachment of gill membrane opposite 5th (4-5) pectoral ray. Upper ...achment of axial dermal flap opposite 14th (12-16) pectoral ray. Disc ...gth 3.3 (3.2-3.4) in standard length; no flattened papillae in center ...disc region A; disc region B with 4 (4-5) rows of flattened papillae ...oss its width; 4 (3-5) rows across width of disc region C (fig. 18). ...imum known size 71.2 mm. standard length.

COLORATION: No coloration was present in the alcohol specimens examined. ...ham (1953, p. 372) has given the life colors as follows; "For the most ...t they range from pink to red on the back, sometimes with longitudinal ...ds of brown, or as in others spotted and banded with pale yellow. Some ...en had olive-brown markings. Others again were a pale yellow-brown ...eaked with brown blotches. The under-surface and suckers varied from a ...ty white to yellow. The fins are usually pink spotted with a pale yel... Sometimes the Lump-fish matched the surroundings so closely when ...ing on rocks among masses of short seaweed or other marine growth they ...e not easily seen."

RELATIONSHIP: Close to the smaller species, *T. melobesia*, but readily ...arated by the characters listed in the key.

MATERIAL EXAMINED: SU 47692; one specimen from Ship's Cove, Qu Charlotte Sound, New Zealand. SU 47693 and 47694; 15, from Lyall B Wellington, New Zealand. AuM 1B2477-8; two, also from Lyall Bay. 25.10.1911; one, from Napier, New Zealand.

RANGE: New Zealand, from Seal Point south of Otago Heads, north to Ma kau Harbour, Auckland.

Trachelochismus melobesia Phillipps

Figure 19

Crepidogaster simus Rendahl (*non* Hutton), 1925, p. 8 (Queen Charlotte Sour
Trachelochismus melobesia Phillipps, 1927, p. 130, pl. 5 (Makara n Wellington).
Oliverichtus melobesia Whitley and Phillipps, 1939, p. 236, pl. 22, f 5, 6 (near Wellington).

DIAGNOSIS: A small *Trachelochismus* with comparatively long dorsal anal fins. Dorsal-caudal distance measured forward extends to proxi one-half of pectoral fin; postdorsal-caudal distance 1.9 (1.8-2.1) in dor length. Dorsal rays 10 (9-11), anal rays 8 (7-8), pectoral rays 23 (22-2 and caudal rays 12.

DESCRIPTION: Body of medium width and well depressed anteriorly, de 6.0 (5.8-6.2) in standard length. Caudal peduncle medium, depth 1.1 (0 1.2) in its length. Anus located closer to origin of anal fin than to r margin of disc. Head large and well depressed, length 2.4 (2.3-2.5) width 3.1 (3.0-3.3) in standard length. Snout short and rounded in dor outline, 3.6 (3.4-3.8) in head. Anterior nostril with a long, simp dermal flap extending from its posterior margin; posterior nostril loca behind or above anterior edge of eye. Eye 0.8 (0.8-0.9) in bony inter bital space and 4.4 (4.0-4.9) in head.

Upper attachment of gill membrane opposite 6th (5-7) pectoral ra Upper attachment of axial dermal flap opposite 12th (11-13) pectoral r Disc length 3.3 (3.2-3.5) in standard length; disc region A with 4 (4 rows of flattened papillae across its width; disc region B with 5 (5 rows across its width; 4 (4-5) rows across width of disc region C (fig. 1 Maximum known size 30.7 mm. standard length.

COLORATION: The coloration had faded from all of the preserved specim examined. In his original description Phillipps (1927, p. 131) gave coloration as follows: "General ground colour is rose-pink tending to sc let on the tail and fins. The undersurface is pink with yellowish tin on the adhesive apparatus. A deep reddish-purple patch covers most of dorsal surface. This patch extends from behind the eyes to the dors origin and has running across it anteriorly a dotted pattern, behind wh are two fairly wide cross bars of reddish brown."

RELATIONSHIP: Close to the larger species, *T. pinnulatus*, but read separated by the characters listed in the key.

MATERIAL EXAMINED: KZM 5.12.1928.77; one specimen from Queen Charlo Sound, New Zealand. KZM 5.12.1928.73-76; four, also from Queen Charlo Sound. DM (not numbered); two, from Lyall Bay, Wellington, New Zeala DM (not numbered); one, from Island Bay, New Zealand. UMMZ 160887; from Wellington, New Zealand.

RANGE: Vicinity of Cook Strait, New Zealand.

Subfamily HAPLOCYLICINAE, new

Gills three and one-half; gill membranes united and free from isthm disc single. This is a monotypic subfamily confined to New Zealand.

Genus *HAPLOCYLIX*, new

Figures 20, 47; Map 1

pe species: *Cyclopterus littoreus* Forster, 1801.
dy medium in width and depressed anteriorly; head medium and depressed, t a very broad, rounded snout. Nostrils on each side well separated and s nctly tubular. Upper lip narrow and continuous around front of snout. eth small, sharp, recurved, in deep patches towards front of each jaw, t reduced to a single row along sides of jaws. Thirteen narrow, rounded s present on the second gill arch. Edges of gill membranes attached t ally, slightly in front of and well below upper origin of pectoral n No fleshy pad present on lower pectoral base.
orsal fin comparatively short, anal medium in length. Ray counts of e nedian fins may be taken easily but the first pectoral ray is rather a. and may possibly be overlooked. Disc comparatively small and longer a wide. As can be seen by the illustration, the external disc structure ery distinctive (fig. 20).
nbopercular element present, forming the terminal bone posteriorly on e of head. It has no spine. Both pelvis and distal postcleithral bones a characteristic shape from a ventral view (fig. 47). There are 41 ebrae (a comparatively high number), and 6 branchiostegals.
nere seems to be no externally apparent sexual dimorphism.
his is a monotypic genus confined to New Zealand. The name is from the k *haploos*, single; and *culix*, cup, in reference to the single instead ouble type of structure of the ventral disc.

Haplocylix littoreus (Forster)

opterus littoreus Forster *in*: Bloch and Schneider, 1801, p. 199 (Novae Zeelandae).—Cuvier, 1817, p. 226.—Forster, 1844, p. 114 ("insula australi Novae Zeelandiae").
helochismus littoreus Gill, 1893b, p. 101 (New Zealand).—Hutton, 1904, p. 47 (New Zealand).
smogaster hectoris Phillipps (*non* Günther), 1942, p. 48, pl. 15 (Karori Light, Wellington).

IAGNOSIS: A large clingfish with a broad, squarish snout. Dorsal fin fewer rays than anal. Caudal peduncle comparatively long. Dorsal rays -6), anal rays 9 (8-9), pectoral rays 23 (22-23), and caudal rays 8.
ESCRIPTION: Body slender but well depressed anteriorly, depth 7.7 (7.2- in standard length. Caudal peduncle long, depth 2.1 (1.8-2.3) in its th. Anus located much closer to origin of anal fin than to rear margin lisc. Head broad and well depressed anteriorly, length 3.0 (2.8-3.4) width 3.8 (3.4-4.3) in standard length. Snout short and broad, 2.6 -2.7) in head. Anterior nostril with a broad, simple, dermal flap ex- ding from its posterior margin; posterior nostril located in front of rior edge of eye. Eye 1.7 (1.3-2.2) in bony interorbital space and 5.1 -5.9) in head.
Upper attachment of gill membrane opposite 4th (4-5) pectoral ray. Upper achment of axial dermal flap opposite 10th (9-11) pectoral ray. Post- sal-caudal distance in dorsal length 0.5 (0.3-0.7); dorsal-caudal dis- ce measured forward extends to a point behind tip of pectoral fin. Disc gth 4.4 (4.3-4.5) in standard length; no flattened papillae in central tions of disc regions A and B; 2 rows of flattened papillae across width lisc region C. Maximum known size 104.5 mm. standard length.

COLORATION: No coloration was left on any of the preserved speci available for examination. In the original description, Forster (*in* B and Schneider 1801, p. 199) mentions the presence of obscure dark sp Phillipps (1942, p. 48) has described the color as follows: "Olive-gr lighter below, with brownish yellow tinges on the fins, brown spot mandible, iris of eye golden; fins turning red in spirits."

RELATIONSHIP: A unique, relict species, the only known member of subfamily.

MATERIAL EXAMINED: DM (not numbered); one specimen from Karori Li Wellington, New Zealand. DM (not numbered); one, from Lyall Bay, Well ton. SU 47678; two, also from Lyall Bay.

RANGE: Vicinity of Wellington, New Zealand.

Subfamily LEPADOGASTRINAE

LEPADOGASTRINAE, Jordan and Fowler, 1902, p. 413

Gills three and one-half; gill membranes attached to isthmus; d double. There are five genera and 12 species; with the exception of species (*Diplecogaster megalops*) in South Africa, all are confined to Eastern North Atlantic, including the Mediterranean.

ARTIFICIAL KEY TO THE GENERA OF LEPADOGASTRINAE

1a. Dorsal and anal fins reduced to low ridges with the rays very we body long and narrow with 38 vertebrae; disc small, length 5.3-6. standard length.....*Gouania* (p.

1b. Dorsal and anal fins normal with strong rays; body comparatively sh and broad with 29-34 vertebrae; disc larger, length 3.2-4.6 in stan length.

2a. A strong, pungent, subopercular spine present; 16 pectoral rays... .....*Oneatogenys* (p.

2b. No spine in subopercular region; 20-29 pectoral rays.

3a. Small incisors at the front of each jaw followed on each side by well-developed canines; 6 rakers on third gill arch..... .....*Apletodon* (p.

3b. No incisors or well-developed canines present; 7-18 rakers on th gill arch.

4a. Dorsal rays 4-9; anal rays 3-8; premaxillaries short and maxilla well forward in position (fig. 74).....*Diplecogaster* (p.

4b. Dorsal rays 13-21; anal rays 9-12; premaxillaries relatively l and maxillaries in a posterior position (figs. 75 and 76)..... .....*Lepadogaster* (p.

Genus *GOUANIA* Nardo

Figure 48; Map 5

Gouania Nardo, 1833, p. 548 (type species *Gouania prototypus* Nardo, original designation, according to Jordan, 1919c, p. 176).

Rupisuga Swainson, 1839, p. 339 (type species *Rupisuga nicensis* Swains by monotypy).

on Gistel, 1848, p. ix (type species *Lepadogaster piger* Nardo, 1827, by original designation).
pterygius Troschel, 1860, p. 205 (type species *Leptopterygius coccoi* Troschel, by monotypy).

dy slender and laterally compressed; head rounded in dorsal outline, not produced. Upper lip, as delineated by the premaxillary groove, to be slightly wider at sides than at tip of snout.
eth small, conical, recurved, in deep patches toward front of each becoming narrowed to a single row along sides. Teeth at corners of jaw the largest. Pseudobranch absent. Six small, pointed rakers on gill arch. No fleshy pad present on lower pectoral base.
rsal and anal fins modified into low ridges, continuous with caudal.
ture of the disc about the same as that illustrated for the genus ogaster (fig. 21), except no papillae in region A, and those in regions C comparatively large and few in number.
emaxillary bones very short and broad and extend laterally as long ed processes; maxillaries considerably elongated (fig. 72). Subop- ar element present and is the terminal bone posteriorly on head. It o spine. The pelvis has a characteristic shape from a ventral view 48), and these bones are more slender than in related genera. There 8 vertebrae, and 6 branchiostegals.
evidence of an external sexual dimorphism was seen.
is genus is monotypic and is confined to the Mediterranean Sea.

Gouania wildenowi (Risso)

Figure 72

ogaster wildenowi Risso, 1810, p. 75, pl. 4, fig. 10 (Nice); 1826, p. 276 (Nice).
ogaster piger Nardo, 1827, p. 9 (Adriatic).
ia prototypus Nardo, 1833, p. 548.
uga nicensis Swainson, 1839, p. 339.
ia piger Bonaparte, 1846, p. 64.
ia pira Nardo, 1860, p. 79.
pterygius wildenowi Troschel, 1860, p. 206.
pterygius coccoi Troschel, 1860, p. 207, pl. 7.
pterygius piger Günther, 1861, p. 515 (Nice, Genoa, Messina).
ia wildenowi Moreau, 1881, p. 364 (Nice).—Carus, 1893, p. 691 (Alicante, Nizza, Genova, Messina, Catania, Venezia, Trieste, Lesina, Bua, Spalato).—Ninni, 1933, p. 35, pl. 8, fig. 2.—Šoljan, 1948, p. 108, fig. 224 (Adriatic).

AGNOSIS: A medium sized fish with rudimentary dorsal and anal fins. slender and laterally compressed, depth 7.0 (6.6-7.6) in standard h. There are no flattened papillae in disc region A. Dorsal rays 16 9), anal rays 15 (13-20), pectoral rays 19 (18-21), and caudal rays 12 4).
SCRIPTION: Anus located slightly closer to rear margin of disc than to fin origin, or halfway between these structures. Head depressed, h 3.6 (3.4-3.7) and width 5.1 (4.6-5.4) in standard length. Snout in l outline short, broad, and rounded, 2.8 (2.6-3.1) in head. Anterior il with a large, simple, dermal appendage extending from the posterior n; posterior nostril behind anterior edge of eye. Eyes 2.0 (1.6-2.0) ny interorbital space and 7.7 (6.0-9.0) in head.
pper attachment of gill membrane occurs opposite 6th (4-7) pectoral ray. attachment of axial dermal flap opposite 14th (13-16) pectoral ray.
al-caudal distance measured forward extends only from one-fourth to

one-half distance to tip of pectoral fin; postdorsal-caudal distance (3.0-4.3) in dorsal length. Length of disc 5.8 (5.3-6.3) in stand length; disc region B with 2 (1-2) rows of large flattened papillae ac its width; 2 (2-3) rows across width of disc region C. Maximum known 49.4 mm. standard length.

COLORATION: In alcohol, all specimens were without coloration. The colors have been given as grayish, pale yellowish, or as a dead leaf reddish dots.

RELATIONSHIP: This peculiar species has no known close relatives.

MATERIAL EXAMINED: SU 18733; two specimens from Syria. MUT 2348; from the west coast of Italy. SU 18732; one, from Monaco. SU 18731; th from Nice, France. USNM 49344; four, from Nice. KZM 26.11.1888; two, Nice. BM (not numbered); two, from Banyuls-sur-Mer, France

RANGE: The Mediterranean Sea from Syria to Banyuls-sur-Mer, France.

REMARKS: Judging from his text, there is little doubt that Risso (1 p. 75) was the first to describe this species although his figure (fig. was evidently drawn from a young specimen of *Lepadogaster lepadoga lepadogaster*.

Genus *OPEATOGENYS*, new

Map 5

Type species: *Mirbelia gracilis* Canestrini 1864.

Body subcylindrical anteriorly; head more or less triangular in dor outline, snout only slightly produced. Head highly depressed, length and width 3.8 in standard length. Nostrils on each side well separated distinctly tubular; tube of anterior nostril long, without an appendage rim. Upper lip, as delineated by premaxillary groove, narrow and not ticeably wider at sides than at front.

Teeth small, conical, recurved, in deep patches toward front of each narrowing to a single row along sides of jaws, larger than those found front. Five short, blunt rakers on third gill arch. No fleshy pad pres on lower pectoral base.

Median fins very short. Dorsal rays 3, anal rays 4, and caudal rays Sixteen pectoral rays. Disc medium in size, length 3.9 in standard leng External structure of disc about as in the genus *Lepadogaster* (fig. 21).

Shape of subopercular element is quite distinctive, being developed a strong, pungent spine. Shape and position of maxillaries about as *Diplecogaster* (fig. 74), but premaxillaries a little more elongate. Sh of pelvis also essentially as in the latter genus (fig. 49). There are vertebrae, and 5 branchiostegals.

There is probably an external sexual dimorphism, since the urogeni papilla was quite elongate in the one specimen (a male) available for ex ination (see the specific description).

This genus is monotypic and is confined to the Mediterranean Sea. name is from the Greek *opeas, opeatos*, an awl; and *genus*, cheek; in ref ence to the strong, pointed subopercular spine.

Opeatogenys gracilis (Canestrini)

Mirbelia gracilis Canestrini, 1864, p. 195, pl. 3, fig. 7 (Nizza).—Kol batović, 1900, p. 18 (Adriatic).

Lepadogaster gracilis Moreau, 1881, p. 363 (Nice).—Carus, 1893, p. (Nizza, Messina).—Ninni, 1933, p. 33, pl. 8, fig. 1 (Nizza).—S jan, 1948, p. 111, fig. 232 (Adriatic).

AGNOSIS: A small fish with a strong, pungent spine concealed in the ercular membrane. Body slender and almost cylindrical in shape, depth .n standard length. Five short, blunt rakers present on third gill Male with a long, slender, urogenital papilla, its length about one- body depth at anus. Dorsal rays 3, anal rays 4, pectoral rays 16, and l rays 9.

SCRIPTION: Caudal peduncle long, its depth 1.8 in its length. Anus ed closer to anal fin origin than to rear margin of disc, and well in of dorsal origin. Head highly depressed, length 2.8 and width 3.8 in ard length. Snout in dorsal outline short and rounded, 3.1 in head. rior nostril behind anterior edge of eye. Eye 1.1 in bony interorbital and 4.0 in head.

pper attachment of gill membrane opposite 3rd pectoral ray. Upper hment of axial dermal flap opposite 7th pectoral ray. Dorsal-caudal nce measured forward extends only slightly over one-half the distance en dorsal origin and tip of pectoral fin; postdorsal-caudal distance n dorsal length. Length of disc 3.9 in standard length; disc region B 4 rows of flattened papillae across its width; 4 rows across disc n C. Maximum known size 21.0 mm. standard length.

LORATION: In alcohol, the single specimen examined was completely d of coloration. In life, the body color has been reported as red- t with white spots.

LATIONSHIP: So far there are no known close relatives of this, the species in the genus.

TERIAL EXAMINED: SU 47898; one specimen from Messina, Sicily. Cleared tained.

NGE: The Mediterranean Sea from the Adriatic to Nice, France.

Genus *APLETODON*, new

Nat 5

pe species *Lepadogaster microcephalus* Brook, 1890.

dy moderately depressed anteriorly; head more or less triangular in l outline, snout only slightly produced. Head moderately depressed, h 2.3-2.8 and width 2.6-3.7 in standard length. Nostrils on each side separated and distinctly tubular; anterior nostril usually has a very dermal flap projecting from its posterior margin in *A. microcephalus*, tructure is absent in the other species. Upper lip, as delineated by xillary groove, is slightly wider at sides of snout than at tip.

eth at front of each jaw small, rounded incisiors, followed on each by 1-3 well-developed canines, followed in turn by a row of small al teeth. Six, shallow, blunt rakers on third gill arch. Edges of membranes attached laterally very close to upper pectoral base and d upper origin of fin. There may be a slight swelling on lower ral base but no well-developed, fleshy pad.

dian fins comparatively short. Dorsal rays 5-6, anal rays 5-7, and l rays 10-12. Pectoral rays vary from 21 to 25. Usually the dorsal nal ray counts can be taken without difficulty but the first pectoral s often very small and apt to be overlooked. Disc medium, length 3.3- n standard length. External structure of disc about as in *Lepadogaster* 21). Anus surrounded by about 18-20 fleshy papillae which form a eable cluster; these structures present in both sexes but are better oped in the males.

emaxillary bones short and broad, with the maxillaries lying somewhat posteriorly than in related genera (fig. 73). Subopercular element nt; it is the terminal bone posteriorly. It has no spine. Pelvic

structure essentially as that in *Diplecogaster* (fig. 49) except that it relatively less wide from a ventral aspect. There are 29-32 vertebrae, 6 branchiostegals.

The same type of external sexual dimorphism is apparent in both spec included in this genus. In the mature male the sides of the head beh the eyes are considerably expanded, giving a "puffed-out" effect. T urogenital papillae are also larger in the males and, as mentioned abo the other fleshy papillae in the anal region are more prominent.

There are two known species in this genus, confined to the north temp ate waters of the Eastern Atlantic, including the Mediterranean.

DERIVATION OF NAME: From the Greek *apletos*, immense, extraordinary; *odous (odon)*, tooth; in reference to the teeth, which are more highly d ferentiated than in the other genera in this subfamily.

Artificial Key to the Species of *Apletodon*

1a. Head length 2.7 (2.5-2.8) in standard length; body depth 5.7 (5.5-6 in standard length; 2 (1-2) pairs of small rounded incisors at front upper jaw; disc length 4.1 (3.6-4.6) in standard length..... ..... *microcephalus* (p.

1b. Head length 2.3 in standard length; body depth 5.2 (5.1-5.2) in sta ard length; 5 (4-5) pairs of small rounded incisors at front of up jaw; disc length 3.4 (3.3-3.5) in standard length..... ..... *pellegrini* (p.

Apletodon microcephalus (Brook)

Figure 73

Lepadogaster microcephalus Brook, 1890, p. 166 (west coast of Scotlan —Fage, 1935, pl. 412 (Ecosse, Manche, Golfe de Gascogne, Medite ranée).

Lepadogaster stictopteryx Holt and Byrne, 1898, p. 589. —Byrne, 190 p. 102.

DIAGNOSIS: An *Apletodon* easily distinguished by relative shortness head, its length 2.7 (2.5-2.8) in standard length. Body depth 5.7 (5. 6.1) and disc length 4.1 (3.6-4.6) in standard length. Dorsal rays 6 (5-6 anal rays 6 (5-7), pectoral rays 22 (21-24), and caudal rays 10 (10-11).

DESCRIPTION: Caudal peduncle fairly long, its depth 1.3 (1.2-1.6) in length. Anus located well in front of dorsal origin and usually a litt closer to anal fin origin than to rear margin of disc. Snout in dors outline short and rounded, 3.3 (3.1-3.5) in head. Anterior nostril usua with a very small dermal flap attached to the posterior margin; poster nostril above or behind anterior edge of eye. Eye 1.1 (0.9-1.2) in bo interorbital space and 4.7 (4.3-5.1) in head. Three (2-4) pairs of sma rounded incisors at front of lower jaw; these followed on each side by (1-3) canines, followed in turn by a row of small, conical teeth. Upp jaw with 2 (1-2) pairs of small, rounded incisors at front, followed each side by 2 (1-3) canines, followed in turn by a row of small conic teeth.

Upper attachment of gill membrane occurs opposite 4th (3-5) pectoral r Upper attachment of axial dermal flap opposite 12th (10-14) pectoral ra Dorsal-caudal distance measured forward extends to distal one-third of p toral fin. Postdorsal-caudal distance 0.8 (0.7-0.8) in dorsal length. D region A with 5 (4-5) rows of flattened papillae across its width; 6 (5- rows across width of region B; 4 (3-5) rows across region C. Six shall

t rakers on third gill arch. Maximum known size 41.6 mm. standard th.

OLORATION: In alcohol, most specimens colorless; one with considerable on the lower portions of the dorsal and anal fins. The life colors are ted as green with a darker mottling, or maroon spotted with mahogany, possessing large, white dorsal spots. The adult male is supposed to a large black or purple spot on the dorsal and anal fins and purple s on the throat, whereas these parts are not pigmented in the female.

ELATIONSHIP: Close to its southern cognate, but separated by differ- s in head size, dentition, body depth, and disc length.

ATERIAL EXAMINED: KZM 1.12.1893; one specimen from Messina, Sicily. (not numbered); three, from Concarneau, France. BM (number not record- six, from Roscoff, France. BM 1892.5.10; two, from Archagoil Bay. BM .10.15; one, from Loch Craignish, Argyll, Scotland.

ANGE: From Messina, Sicily, to Loch Craignish, Argyll, Scotland.

Apletodon pellegrini (Chabanaud)

dogaster bimaculatus (*non* Bonnaterre) Steindachner, 1868, p. 686 (Tene- riffe).—Vinciguerra, 1893, p. 324 (Tenerife).—Pellegrin, 1907, p. 87 (Gorée, Chalut); 1914, p. 84 (Senegal, Rufisque, Gorée, Baie de Hann, between Dakar and Cap de Nez).

dogaster (*Mirbelia*) *pellegrini* Chabanaud, 1925, p. 283, 286 (Senegal, Cape Blanco, Madeira, Cape Verde Islands).—Chabanaud and Monod, 1926, p. 285, fig. 33 (Cape Blanco, Canaries, Cape Verde Islands, Madeira).

dogaster pellegrini Fowler, 1936, p. 1079, fig. 452 (Madeira, Canaries, Cape Verde Islands, Cape Blanco, Senegal).

elia sp. 1 Cadenat, 1950, p. 280, fig. 223, 224, (Dakar).

IAGNOSIS: An *Apletodon* with a relatively long head, length 2.3 in stan- length. Body depth 5.2 (5.1-5.2) and disc length 3.4 (3.3-3.5) in dard length. Dorsal rays 6, anal rays 5, pectoral rays 23 (22-25), and al rays 11 (10-12)

ESCRIPTION: Caudal peduncle medium, its depth 1.1 (1.0-1.2) in its th. Anus located well in front of dorsal origin and a little closer to fin origin than to rear margin of disc. Snout in dorsal outline short rounded, 3.3 (3.2-3.5) in head. Anterior nostril without a dermal flap ched to the posterior margin; posterior nostril above or behind anter- edge of eye. Eye 1.2 (1.0-1.3) in bony interorbital space and 4.6)-5.0) in head. Three (2-4) pairs of small, rounded incisors at front ower jaw; these followed on each side by 2 (2-3), followed in turn by a of small conical teeth. Upper jaw with 5 (4-5) pairs of small, rounded sors at the front, followed on each side by 2 (2-3) canines, followed urn by a row of small, conical teeth.

pper attachment of gill membrane opposite 4th (3-4) pectoral ray. Upper chment of axial dermal flap opposite 11th (9-13) pectoral ray. Dorsal- ial distance measured forward extends to distal one-third of pectoral Postdorsal-caudal distance 0.9 (0.8-1.0) in dorsal length. Disc ion A with 5 (5-6) rows of flattened papillae across its width; 8 (7-8) s across width of disc region B; 5 (5-6) rows across region C. Six llow, blunt rakers on the third gill arch. Maximum known size about 0 mm. standard length.

COLORATION: In alcohol, all specimens were colorless with no pigment es remaining. The life colors have been reported as carmine red with es of greenish pigment. The dorsal and anal fins are said to have lish oblique lines which become transverse on the caudal fin.

RELATIONSHIP: Close to its northern cognate, but separated by differences

in head size, dentition, body depth, and disc length.

MATERIAL EXAMINED: KZM 12.6.1906; three specimens from Dakar, Senega French West Africa. SU 18730; one, from the same locality. MHNP 0725 one (holotype of *Lepadogaster pellegrini*), from Senegal.

RANGE: Dakar, Senegal, French West Africa, to the Cape Verde, Canar and Madeira islands.

Genus *DIPLECOGASTER* Fraser-Brunner

Figure 49; Map 4

Diplecogaster Fraser-Brunner, 1938, p. 415 (type species *Cyclopter bimaculatus* Bonnaterre, 1788, by original designation).

Body moderately depressed anteriorly; head more or less triangular dorsal outline, snout only slightly produced. Head moderately depresse length 2.4-3.1 and width 3.2-4.8 in standard length. Nostrils on each si well separated and distinctly tubular; anterior nostril may have a ve small dermal flap projecting from its posterior margin in one species (*bimaculata bimaculata*) but it is absent in the others. Upper lip, delineated by the premaxillary groove, usually a little wider at sides snout than at tip.

Teeth small, conical, more or less recurved, in deep patches towa front of each jaw, narrowing to a single row along sides of jaws, larg than those found at the front. Seven to 18 small, shallow rakers on thi gill arch. Edges of gill membranes attached laterally fairly close upper pectoral base and directly below or in front of upper origin of th fin. No fleshy pad present on lower pectoral base.

Median fins comparatively short. Dorsal rays 4-9, anal rays 3-8, a caudal rays 9-14. Pectoral rays vary from 21-26. Usually dorsal and an ray counts can be taken without much difficulty, but the first pectoral r is often very small and apt to be overlooked. Disc medium, length 3.4-4 in standard length. External structure of disc is about as in *Lepadogast* (fig. 21).

Premaxillary bones short and broad with the maxillaries lying wel forward (fig. 74). Subopercular element present and is the terminal bon posteriorly on the head. It has no spine. Pelvis has a characteristi shape from a ventral view (fig. 49). There are 30-32 vertebrae, and branchiostegals.

The life colors and color patterns are unknown except in *D. bimacula bimaculata* where they are extremely variable.

An external sexual dimorphism is apparent in the above species in tha the head of the male is noticeably broader and the urogenital papilla i larger. Sexual differences were not found in the other three species, bu only a very small number of individuals was available for examination.

There are four known species and subspecies in this genus, three o which are found in the north temperate waters of the Eastern Atlantic in cluding the Mediterranean. The fourth species (*D. megalops*) is found i the south temperate waters of the Western Indian Ocean near Durban, Nata South Africa.

Artificial Key to the Species of *Diplecogaster*

1a. Dorsal rays 4-7; anal rays 3-7; 7-9 small, shallow rakers on third gi arch.

2a. Eyes 0.7-1.2 in bony interorbital space and 3.2-4.9 in head.

3a. Pectoral rays 23 (21-24), rarely 25; depth of caudal peduncle 1.

(1.2-1.5) in its length; eyes 0.9 (0.8-1.2) in bony interorbital space and 4.1 (3.7-4.9) in head.....*bimaculata bimaculata* (p. 29)
. Pectoral rays 25 (25-26); depth of caudal peduncle 1.1 (1.0-1.2) in its length; eyes 0.7 (0.7-0.8) in bony interorbital space and 3.6 (3.2-3.9) in head.....*bimaculata pectoralis* (p. 30)
Eyes 0.5-0.6 in bony interorbital space and 3.0-3.2 in head.....
.....*megalops* (p. 31)
Dorsal rays 9; anal rays 8; about 18 small, shallow rakers on third gill arch.....*ctenocrypta* (p. 32)

Diplecogaster bimaculata bimaculata (Bonnaterre)

Figure 74

opterus bimaculatus Bonnaterre, 1788, p. 29, pl. 86, fig. 355 (the seas of England).—Walbaum, 1792, p. 490.—Bloch and Schneider, 1801, p. 199 (British seas).—Shaw, 1804, p. 398 (European seas).—Donovan, 1806, pl. 78.
dogaster ocellatus Risso, 1810, p. 74 (Villefranche).
dogaster reticulatus Risso, 1810, p. 77 (Nice); 1826, p. 277 (Nice).—Bonaparte, 1846, p. 65.
dogaster mirbeli Risso, 1820, p. 249; 1826, p. 277 (Nice).—Bonaparte, 1846, p. 65.
dogaster desfontanii Risso, 1826, p. 275 (Nice).—Bonaparte, 1846, p. 65.
adogaster nitidus Macquart, 1826, p. 333.
dogaster bimaculatus Fleming, 1828, p. 190 (English coast).—Bonaparte, 1846, p. 65.—Nilsson, 1855, p. 241 (England and Ireland to Western Norway).—Günther, 1861, p. 514 (Mediterranean to British Coasts and Scandinavia).—Day, 1880, p. 192, pl. 57, fig. 3 (Scandinavia, British Coast, France, to Algeria and Italy in the Mediterranean).—Moreau, 1881, p. 361 (Nice, Marseille, Golfe de Gascogne, Arcachon, Manche, Cherbourg?).—Carus, 1893, p. 690 (Alger, Marseille, Nizza, Genova, Napoli, Reggio, Calabr., Sicilia, Messina, Venezia, Trieste, Zaole, Spalato, Cyclades).—Hoek, 1914, p. 34 (Trondhjemsfjord, Manche, coast of Ireland).—Ninni, 1933, p. 30, pl. 7.—Jenkins, 1936, p. 107 (Mediterranean to British Isles).—Šoljan, 1948, p. 111, fig. 233 (Adriatic).
dogaster norvegicus Düben, 1844, p. 112.
dogaster maculatus Guichenot, 1850, p. 109, pl. 6, fig. 4 (Algeria).
dogaster punctatus Guichenot, 1850, p. 110, pl. 6, fig. 5 (Algeria).
dogaster lineatus Guichenot, 1850, p. 110, pl. 6, fig. 3 (Algeria).
dogaster urifasciatus Costa, 1850, p. 9 (Napoli).
dogaster latirostris Costa, 1850, p. 4 (Napoli).
dogaster raninus Nardo, 1860, p. 79.
dogaster listellus Nardo, 1860, p. 79.
dogaster elegans Nardo, 1860, p. 79.
belia desfontainii Canestrini, 1864, p. 192, pl. 3, fig. 5, 6 (Nizza).—Ninni, 1912, p. 138 (Adriatic).
dogaster couchii Kent, 1883, p. 54.
dogaster dentatus Facciolá, 1887, p. 25 (sea of Sicily).—Spartá, 1946, p. 140, pl. 1 (eggs and larvae).
belia maculata de Buen, 1926, p. 85 (Spanish Mediterranean).
belia bimaculata de Buen, 1935, p. 146 (Atlantic and Mediterranean Iberia).
lecogaster bimaculatus Fraser-Brunner, 1938, p. 410 (British Isles).

DIAGNOSIS: A large *Diplecogaster* with a comparatively long caudal peduncle, its depth 1.3 (1.2-1.5) in its length. Eyes 0.9 (0.8-1.2) in bony

interorbital space and 4.1 (3.7-4.9) in head. Upper attachment of axi dermal flap opposite 11th (10-12) pectoral ray. Dorsal rays 6 (5-7), an rays 5 (4-6), pectoral rays 23 (21-25), and caudal rays 9 (9-10).

DESCRIPTION: Body depressed, depth 5.7 (4.9-6.8) in standard lengt Anus located about midway between rear margin of disc and anal fin origi and well in front of dorsal origin. Head moderately depressed, length 2. (2.4-3.1) and width 3.8 (3.2-4.8) in standard length. Snout in dorsal ou line short and rounded, 3.5 (3.3-3.8) in head. Posterior nostril above just behind anterior edge of eye; anterior nostril usually with a ver small, simple, dermal flap projecting from its posterior margin; occasio ally flap is absent. Nine very shallow, blunt rakers on third gill arch.

Upper attachment of gill membrane opposite 4th (2-5) pectoral ra Dorsal-caudal distance measured forward may reach tip of pectoral but us ally falls behind it; postdorsal-caudal distance 0.8 (0.7-1.1) in dorsa length. Length of disc 4.0 (3.4-4.3) in standard length; disc region with 4 (4-5) rows of flattened papillae across its width; 6 (5-6) ro across width of region B; 3 rows across region C. Maximum known size 41. mm. standard length.

COLORATION: In alcohol, there were no traces of coloration in most of t specimens. A few of them had some red remaining on the vertical fins a especially concentrated in two large round spots, one on each side of t body, partially under the tip of the lower part of the pectoral fin. life, the colors and patterns are highly variable, judging from the ma species that have been described on the basis of color differences.

RELATIONSHIP: This form is closely related to its subspecies to t south, *Diplecogaster bimaculata pectoralis*, differing principally in havi fewer pectoral rays, a longer caudal peduncle, and a smaller eye.

MATERIAL EXAMINED: NMW (not numbered); two specimens from Zákyntho Island, Greece. KZM 1.12.1893; two, from Messina, Sicily. GM (not num bered); one, from Messina. SU 18739; three, from Messina. SU 18738; on from the west coast of Italy. SU 18737; one, from Monaco. MHNP A4961 A4963, and 5823; six (holotype of *Lepadogaster maculatus*, holotype o *L. lineatus*, and four syntypes of *L. punctatus*), from Algeria. USNM 8627 one, from Gibraltar. BM 1896.5.20; one, from the coast of Spain. IOM (n numbered); one, from the coast of Brittany. IOM (not numbered); one, fr near Brest. BM 1906.7.2; six, from Roscoff, France. SU 18736; two, fr Plymouth, England. BM 1951.2.19; eight, from the English Channel. BM 189 6.18; one, from off Saltees, England. BM 1947.12.1; one, from Wembary Ba Devon, England. BM 1888.4.3; one, from Campbelltown Loch, Scotland. (number not recorded); 10; from the British coasts. UMMZ 147293; one, fr Flarö, Norway. KZM 28.8.1900; one, from the Faeroe Islands.

RANGE: The Mediterranean from the Adriatic to Gibraltar and north t Trondhjemsfjord, Norway, and the Faeroe Islands.

REMARKS: This species was first described and figured by Pennant in 17 (vol. 3, p. 397, pl. 22), who called it the "bimaculated sucker". It i usually taken from much deeper water than are the various species o *Lepadogaster*. Guitel (1919, p. 5) reported the capture of an adult spec men from a depth of 20 meters in the Mediterranean near Cape de Gata, Spai He also reported the capture of "alevin" clingfishes (either *Diplecogast bimaculatus* or *Apletodon microcephalus*) from depths up to 490 meters.

Diplecogaster bimaculata pectoralis, new subspecies

Figure 83

Lepadogaster gouani (*non* Risso) Günther, 1880, p. 3 (St. Vincent, Cap Verde).

Lepadogaster bimaculatus (*non* Bonnaterre) Guitel, 1919, p. 8 (near th

Azores).—Fowler (*non* Bonnaterre) 1936, p. 1080 (Azores).
belia sp. 2 Cadenat, 1950, p. 280, fig. 225, 226 (Dakar).

DIAGNOSIS: A small *Diplecogaster* with a comparatively short caudal pe.e, its depth 1.1 (1.0-1.2) in its length. Eyes 0.7 (0.7-0.8) in bony rorbital space and 3.6 (3.2-3.9) in head. Upper attachment of axial al flap opposite 11th (10-13) pectoral ray. Dorsal rays 7, anal rays -7), pectoral rays 25 (25-26), and caudal rays 11 (10-12).
DESCRIPTION: Body depressed, depth 5.8 (5.6-6.4) in standard length. located closer to anal fin origin than to rear margin of disc, and t in front of dorsal origin. Head moderately depressed, length 2.7 -2.8) and width 3.8 (3.6-4.2) in standard length. Snout in dorsal ine short and rounded, 3.5 (3.3-3.7) in head. Posterior nostril well nd anterior edge of eye; anterior nostril without a dermal appendage on posterior margin. Eight or 9 shallow, blunt rakers present on third arch.
Upper attachment of gill membrane occurs opposite 4th (4-5) pectoral Dorsal-caudal distance measured forward usually reaches tip of pec- al fin, but may fall just short of it. Postdorsal-caudal distance 1.1 9-1.2) in dorsal length. Length of disc 4.3 (3.9-4.6) in standard gth; disc region A with 4 (3-5) rows of flattened papillae across its th; 6 rows across width of region B; 3 rows across region C.
COLORATION: In alcohol, no traces of coloration remained in any of the cimens. The life colors are unknown.
RELATIONSHIP: This form is very close to its subspecies to the north, *lecogaster bimaculata bimaculata*, differing principally in having more toral rays, a shorter caudal peduncle, and a larger eye.
HOLOTYPE: København Zoologisch Museum 2.4.1930; 19.0 mm. in standard gth, collected by Dr. Th. Mortensen off La Luz, Gran Canaria, Canary ands, on April 2, 1930. It was taken with some sponges from a hard tom at about 100 fathoms by a swab device.
PARATYPES: KZM 2.4.1930; one specimen 22.3 mm. standard length, taken n the holotype. SU 18735; one, 18.0 mm. in standard length, from off La , Gran Canaria, collected by Dr. Th. Mortensen on March 28, 1930. It taken with the alga *Hildenbrandtia* from a hard bottom at 90 fathoms a Sigsbee trawl. KZM 28.3.1930; one, 16.0 mm. in standard length, taken n the Stanford paratype. IOM (not numbered); one, 13.1 mm. in standard gth, from station 882, lat. 38° 03' 40" N., long. 28° 34' 45" W. (near the res). BM 1890.2.26; one, 16.5 mm. in standard length, taken near St. cent, Cape Verde Islands, on February 26, 1890, by the "Challenger" edition.
DERIVATION OF NAME: The Latin adjective *pectoralis*, of the breast, refers the pectoral fins, which have a relatively higher number of rays in this thern subspecies.

Diplecogaster megalops, new species

Figure 84

DIAGNOSIS: A small *Diplecogaster* with 7 small, shallow, pointed rakers third gill arch. Caudal peduncle comparatively short, its depth 1.1 0-1.2) in its length. Eyes 0.6 (0.5-0.6) in bony interorbital space and (3.0-3.2) in head. Upper attachment of axial dermal flap opposite 11th -12) pectoral ray. Dorsal rays 5 (4-5). anal rays 4 (3-4), pectoral s 23 (23-24), and caudal rays 10.
DESCRIPTION: Body only slightly depressed, depth 5.2 (5.0-5.3) in stan- length. Anus a little closer to rear margin of disc than to anal fin gin and well in front of dorsal origin. Head moderately depressed,

length 2.8 (2.7-2.8) and width 3.3 (3.3-3.4) in standard length. Snout dorsal outline short and rounded, 3.2 (3.2-3.3) in head. Posterior nostr well behind anterior edge of eye; anterior nostril without a dermal appen age on its posterior margin.

Upper attachment of gill membrane opposite 4th (3-4) pectoral ra Dorsal-caudal distance measured forward does not extend as far as tip pectoral fin. Postdorsal-caudal distance 0.7 (0.6-0.7) in dorsal lengt Length of disc 3.5 (3.4-3.6) in standard length; disc region A with 4 (4- rows of flattened papillae across its width; 5 rows across width of di region B; 3 (3-4) rows across disc region C.

COLORATION: In alcohol, no traces of coloration remain in the specimen The life colors are unknown.

RELATIONSHIP: This species is more closely related to *Diplecogast bimaculata bimaculata* than to any other member of the genus. In additi to the marked difference in eye size (in specimens of comparable size there are differences in length of caudal peduncle and length of snout.

HOLOTYPE: København Zoologisch Museum number 22.7.1929; 19.6 mm. standard length, collected by Dr. Th. Mortensen off Durban, Natal, Sou Africa, on July 22, 1929. It was taken with sponges from a sand bottom 120 fathoms by a scraper device.

PARATYPES: SU 18734; one specimen, 19.2 mm. in standard length, tak with the holotype. KZM 29.8.1929; two, 16.8 mm. and 16.7 mm. in standa length, collected by Dr. Th. Mortensen off Durban on August 29, 1929; the were taken from a sand and gravel bottom at 68 fathoms by a scraper.

DERIVATION OF NAME: The name is from the Greek *megas*, large; *ops*, eye.

Diplecogaster ctenocrypta, new species

Figure 85

DIAGNOSIS: A small *Diplecogaster* with about 18 very small, pointe rakers on third gill arch. Caudal peduncle is comparatively short, it depth 1.2 in its length. Eyes 0.7 in bony interorbital space and 3.2 head. Upper attachment of axial dermal flap opposite 13th pectoral ra Dorsal rays 9, anal rays 8, pectoral rays 25, and caudal rays 14.

DESCRIPTION: Body moderately depressed, depth 5.4 in standard lengt Anus located closer to anal fin origin than to rear margin of disc and front of dorsal origin. Head moderately depressed, length 2.5 and wid 3.6 in standard length. Snout in dorsal outline short and rounded, 3.3 head. Posterior nostril well behind anterior edge of eye; anterior nostr without a dermal appendage on its posterior margin.

Upper attachment of gill membrane opposite 8th pectoral ray. Dorsa caudal distance forward extends to about the proximal one-third of pector fin. Postdorsal-caudal distance 1.4 in dorsal length. Length of disc 4 in standard length; disc region A with 3 rows of flattened papillae acro its width; 6 rows across width of region B; 4 rows across region C.

COLORATION: In alcohol, no traces of coloration remain in the specime The life colors are unknown.

RELATIONSHIP: This species is easily distinguished from the othe members of the genus principally by its numerous fine gill rakers, t greater number of rays in the median fins, and by a lower attachment of t gill membranes.

HOLOTYPE: København Zoologisch Museum 28.3.1930; 16.7 mm. in standa length, collected by Dr. Th. Mortensen off La Luz, Gran Canaria, Cana Islands, on March 28, 1930. It was taken with the alga *Hildenbrandtia* fr a hard bottom at 90 fathoms with a Sigsbee trawl.

DERIVATION OF NAME: The name is from the Greek *ctenos*, comb; and *krypto* hidden; and refers to the distinctive structure of the gill rakers.

Genus *LEPADOGASTER* Gouan

Figures 1, 21, 50; Map 3

dogaster Gouan, 1770, p. 106, 177, pl. 1, fig. 6, 7 (type species *Cyclopterus lepadogaster* Bonnaterre 1788, by tautonymy).
cephalus Rafinesque, 1810, p. 63 (type species *Piesocephalus adherens* Rafinesque, by monotypy).
elia Canestrini, 1864, p. 189 (type species *Lepadogaster decandollii* Risso 1826, by subsequent designation of Jordan, 1919c, p. 329).
dogasterus Duméril, 1806, p. 108 (type species *Cyclopterus lepadogaster* Bonnaterre 1788, by subsequent designation of Fowler, 1936, p. 1078).

ody moderately depressed anteriorly; head elongated in dorsal outline, t noticeably produced and rounded at end. Head moderately depressed, th 2.2-2.6 and width 3.0-4.3 in standard length. Nostrils on each side separated and distinctly tubular; anterior nostril with an appendage its posterior margin in the form of a very small dermal flap in *L.* gillei and appearing as a large cirrus in the other forms. Upper lip, as neated by the premaxillary groove, narrow at tip of snout and compara-ly wide at sides.

Teeth small, conical, recurved, in deep patches toward front of each narrowing to a single row along sides of jaws, larger than those found the front. Seven to 10 shallow, blunt rakers on third gill arch. Edges gill membranes attached laterally close to upper pectoral base and post-r to upper origin of this fin. A poorly developed fleshy pad on lower oral base of each species, except *L. canidelli*, where it is absent.

Median fins quite long. Dorsal rays 13-21, anal rays 9-12, and caudal s 10-14. Pectoral rays vary from 20-29. Usually the dorsal and anal counts can be taken without much difficulty, but the first pectoral ray often very small and apt to be overlooked. Disc medium to large, length -4.3 in standard length. External structure of disc about as in other ated genera (fig. 21). However, the size and numbers of the shallow, ttened papillae on the ventral surface vary with the species and serve useful identifying characters.

The elongate, spatulate shape of the premaxillary bones is quite distinc-e, as is the shape and position of the maxillaries (figs. 75 and 76). Opercular element present, it is the terminal bone posteriorly on the d. It has no spine. The pelvis has a characteristic shape from a ral view (fig. 50). There are 31-34 vertebrae.

Lepadogaster candollii is well separated from the other three forms, h are very closely related to each other. The absence of the large al cirrus, the separated median fins, the relatively small differences fin-ray and papilla counts, and the smaller disc are excellent specific racters, but are not generic in scope. Usually generic affinity in se fishes is better determined by a consideration of the dentition and positions and shapes of such bones as the pelvis, postcleithrum, pre-illary and maxillary. The bony disc supports in *L. candollei* are almost ctly the same as in the other species of *Lepadogaster*. The premaxillar-(fig. 76) are shorter and broader, and the maxillaries show a position nge, but these differences are rather small.

In life the colors and color patterns seem to be highly variable and are bably not reliable for taxonomic purposes.

There is no apparent external sexual dimorphism.

There are four known species and subspecies in this genus, confined to th temperate waters of the Eastern Atlantic, including the Mediterra-n and the Black Sea.

Artificial Key to the Species of *Lepadogaster*

1a. A prominent cirrus projecting from rim of anterior nostril; dorsal a anal fins broadly joined to caudal fin; 3-6 rows of flattened papill across width of disc region B; pectoral rays 20-23.
2a. Body depth 5.5-6.8 in standard length.
3a. Four (3-4), rarely 5, rows of flattened papillae across width of di region B; 3 (3-4) rows across width of disc region A; dorsal ra 17 (16-19).....*lepadogaster lepadogaster* (p. 3
3b. Five (5-6) rows of flattened papillae across width of disc region 5 (4-6) rows across width of disc region A; dorsal rays 19 (17-21) .....*lepadogaster purpurea* (p. 3
2b. Body depth 5.0 (4.8-5.3) in standard length.....*zebrina* (p. 3
1b. A very small dermal flap on rim of anterior nostril; dorsal and ana fins separated from caudal fin; 7-9 rows of flattened papillae acros width of disc region B; pectoral rays 26-29.....*candollei* (p. 3

Lepadogaster lepadogaster lepadogaster (Bonnaterre)

Figure 75

Cyclopterus lepadogaster Bonnaterre, 1788, p. 29, pl. 86, fig. 356 (Medi terranean).—Walbaum, 1792, p. 490.
Lepadogaster gouanii Risso, 1810, p. 72 (Nice).—Moreau, 1881, p. 356 fig. 191 (in part; Mediterranean specimens only).—Guitel, 1889 (ana tomical work).—Carus, 1893, p. 689 (East Spain, Alger, Cette, Mar seille, Toulon, Nizza, Genova, Portoferrajo, Lipari, Napoli, Sicilia Messina, Catania, Venezia, Trieste, Zaole, Dalmazia, Spalato, Cyc lades).—Ninni, 1933, p. 18, pl. 1.—Šoljan, 1948, p. 109, figs. 22 227 (Adriatic).
Lepadogaster balbis Risso, 1810, p. 73, pl. 4, fig. 9 (Villefranche); 182 p. 274 (Nice).
Piescephalus adherens Rafinesque, 1810, p. 63 (Sicily).
Lepadogaster ciliatus Risso, 1820, p. 248 (Nice).
Lepadogaster natator Risso, 1820, p. 248 (Nice).
Lepadogaster biciliatus Risso, 1826, p. 272 (Nice).—Ninni, 1933, p. 2 pl. 2.
Lepadogaster brownii Risso, 1826, p. 272 (Nice).—Ninni, 1933, p. 23, pl. —Carus, 1893, p. 689 (Nizza, Perrar).—Šoljan, 1948, p. 110 (Ad riatic).
Lepadogaster webbianus Valenciennes, 1835, p. 85 (Canary Islands).
Lepadogaster bitentaculatus Valenciennes, 1835, p. 85 (*nomen nudum*).
Lepadogaster acutus Canestrini, 1864, p. 187 (Genova).—Carus, 1893, p. 6 (Mare Ligusticum, Venezia, Trieste, Fiume).—Ninni, 1933, p. 2 pl. 4.
?*Lepadogaster adriatica* Hankó, 1921, p. 177.
Lepadogaster lepadogaster Fowler, 1936, p. 1080 (Canaries).
Lepadogaster sp. Cadenat, 1950, p. 277, fig. 227, 228 (Dakar).

DIAGNOSIS: A *Lepadogaster* with a well-developed, spatulate snout. Me brane of dorsal and anal fins broadly connected to caudal fin. A lar cirrus extends from posterior margin of anterior nostril, and a small projection is present on the anterior margin. Body depth 5.9 (5.5-6.8) standard length. Three (3-4) rows of flattened papillae across width disc region A; 4 (3-5) rows across disc region B. Dorsal rays 17 (16-19 anal rays 10 (9-11), pectoral rays 21 (20-23), and caudal rays 12 (12-13).
DESCRIPTION: Caudal peduncle short, least depth 0.8 (0.7-0.9) in it

rch. Anus located close to anal fin origin and under 4th (3-5) dorsal
Head moderately depressed, length 2.3 (2.2-2.3) and width 3.7 (3.0-
in standard length. Snout in dorsal outline elongate and rounded,
(2.8-3.1) in head. Posterior nostril above or just behind anterior
of eye. Eight short, blunt rakers on third gill arch.
reatest diameter of eye 0.8 (0.7-0.9) in bony interorbital space and
(5.3-6.4) in head. Upper attachment of gill membrane opposite 8th (7-
ectoral ray. Upper attachment of axial dermal flap opposite 11th (10-
pectoral ray. Dorsal-caudal distance forward extends well in front of
r pectoral base, as much as halfway between this structure and poster-
margin of eye; postdorsal-caudal distance 4.0 (3.3-4.8) in dorsal
th. Length of disc 3.4 (3.2-3.6) in standard length; disc region C
3 (3-4) rows of flattened papillae across its width. Maximum known
about 65.0 mm. standard length.

OLORATION: In alcohol, most specimens are completely devoid of color-
n. A few have retained a large amount of dark red which is especially
y on the dorsal side. In life, the fish seems to present an almost in-
te array of colors and patterns. This was confusing to some of the
y naturalists leading them to believe that many species existed, each
its characteristic coloration. Risso alone is responsible for six
s which are referable to this subspecies. Fortunately, there is ample
hological justification for the recognition of this subspecies without
ng to depend upon color patterns. The majority of writers do stress
abundance of red pigment.

ELATIONSHIP: This form is very close to *Lepadogaster lepadogaster*
urea, its relative to the north. It tends to have fewer dorsal and
rays, and fewer rows of papillae in disc regions A and B (see table).

	Dorsal Rays						Anal Rays				Rows of Papillae in Region A				Rows of Papillae in Region B			
species	16	17	18	19	20	21	9	10	11	12	3	4	5	6	3	4	5	6
adogaster	6	8	7	2			2	17	4		13	6			2	17	1	
purea		1	13	14	7	2		6	23	9			16	22	1			35	5

Table 1. Subspecies of *Lepadogaster lepadogaster* compared.

MATERIAL EXAMINED: SU 18747; one specimen from Cape Vert, Senegal, ich West Africa. MHNP A4964; two (syntypes of *Lepadogaster webbianus* nciennes), from Canary Islands. IOM (not numbered); one, from Salvage nds. SU 18746; two, from Syria. SU 18744; two, from Sicily. KZM (not bered); one, from Sicily. BM 1891.8.31; one, from Messina. KZM (not bered); one, from Messina. CAS 7595; one, from Palermo, Sicily. AMNH ; numbered); one, from Corsica. USNM 124468; one, from Elba. TM (not bered); one, from Hvar, Yugoslavia. TM (not numbered); three, from a, Yugoslavia. TM (not numbered); two, from Krk, Yugoslavia. TM (not bered); three, from Veliki Kvarner, Yugoslavia. TM (not numbered); one, sibly from Trieste. SU 18748; 10, from Gulf of Genoa. SU 18745; two, n Nice, France. KZM (not numbered); one, from Nice, France. BM 1896.5. three, from the coast of Spain. BM 1867.3.22 and 1845.9.23; two, from Mediterranean.

RANGE: From Dakar, French West Africa, north to the Mediterranean, and m the Black Sea westward throughout the Mediterranean to the Spanish st. Found on the Canary and Salvage islands but does not extend to eira.

REMARKS: This fish was first introduced into the literature by Gouan 70, pl. 1, fig. 6, 7) who gave it a generic name only.

Lepadogaster lepadogaster purpurea (Bonnaterre)

Cyclopterus purpureus Bonnaterre, 1788, p. 29 (Cornwall).
Lepadogaster rostratus Bloch and Schneider, 1801, p. 1 (British seas).
Cyclopterus lepidogaster Turton, 1802, vol. 1, p. 907.
Cyclopterus cornubicus Shaw, 1804, p. 397 (Cornwall and the Sound of Jur
Cyclopterus ocellatus Donovan, 1806, pl. 76 (western coasts of England
Cyclopterus spatula Cloquet, 1818, p. 296 (Cornwall). —Lacépède, 183
p. 321 (Cornwall).
Lepadogaster cornubiensis Fleming, 1828, p. 189 (southern coast of Engla
and the Hebrides).
Cycloptera spathulata Lacépède, 1832, p. 67.
Lepadogaster gouanii (*non* Risso) Günther, 1861, p. 510 (in part; Fren
Atlantic and more northern specimens only). —Day, 1880, p. 189, p
57, fig. 1 (in part; French Atlantic and more northern specime
only). —Hoek, 1914, p. 34 (Orkney and Shetland Islands, England, I
land, Manche). —Jenkins, 1936, p. 107, pl. 40 (in part; French Atla
tic and more northern specimens only). —Yonge, 1949, p. 103, pl. 7.
Lepadogaster lepadogaster Fraser-Brunner, 1938, p. 410 (British Isles).

DIAGNOSIS: Identical with *Lepadogaster l. lepadogaster* except as fo
lows: body depressed, depth 6.3 (5.7-6.8) in standard length; five (4-
rows of flattened papillae across width of disc region A; 5 (5-6) ro
across disc region B; dorsal rays 19 (17-21), anal rays 11 (10-12), pe
toral rays 21 (20-23), and caudal rays 12 (11-14).

DESCRIPTION: Caudal peduncle short, least depth 0.8 (0.7-1.0) in i
length. Anus located close to anal fin origin and under 4th (3-5) dors
ray. Head moderately depressed, length 2.3 (2.2-2.4) and width 3.3 (3.
3.7) in standard length. Snout in dorsal outline elongate and rounde
3.1 (3.0-3.2) in head. Posterior nostril above or just behind anteri
edge of eye. Seven short, blunt rakers on third gill arch.

Greatest diameter of eye 0.8 (0.7-0.9) in bony interorbital space a
5.8 (4.8-6.6) in head. Upper attachment of gill membrane opposite 7
(6-7) pectoral ray. Upper attachment of axial dermal flap opposite 11
(10-13) pectoral ray. Dorsal-caudal distance forward extends well in fr
of upper pectoral base and as much as halfway between this structure a
posterior margin of eye; postdorsal-caudal distance 4.5 (3.9-5.0) in dor
length. Length of disc 3.3 (3.2-3.4) in standard length; disc region
with 4 (3-4) rows of flattened papillae across its width. Maximum kno
size about 75 mm. standard length.

COLORATION: In alcohol, most specimens are completely devoid of colo
ation, although, as in the case of *L. lepadogaster lepadogaster*, a few ha
retained a large amount of red which is especially heavy on the dorsal si
In life, the colors and patterns are highly variable. However, a pair
well-marked ocellations are usually present on the dorsal, posterior si
of the head. A fine colored photograph of a living individual has be
published by Yonge (1949, pl. 7).

RELATIONSHIP: This subspecies is very close to *Lepadogaster lepadogas
lepadogaster*, its relative to the south (see above, paragraph on Relati
ship under *L. l. lepadogaster*).

MATERIAL EXAMINED: BM 1906.7.28; three specimens from Roscoff, Franc
BM 1902.9.3; two, from Côte du Nord, France. KZM 23.8.1867; four, from
land of Guernsey. BM 1920.11.1; six, from Penzance, England. BM 1846.1.
three, from Falmouth, England. BM 1904.10.31; 1946.7.24; nine, from Co
wall, England. BM (number not recorded); 10, from Plymouth, England.
18749; two, from Plymouth. BM 1938.10.12; four, from the Isle of Man;

3 2.1; three, from the British Coast.
NGE: From Roscoff, France, to the Shetland Islands.
MARKS: Day (1880, p. 190) states that this fish ranges from Denmark
n. However, it is not listed by Brunn and Pfaff (1950) in the fish
on of the modern *List of Danish Vertebrates*.
his subspecies was first discovered by William Borlase in 1758 and was
ribed and figured in his famous work *The Natural History of Cornwall*
269, pl. 25, fig. 28, 29). The specific name *purpureus*, given by
aterre (1788, p. 29), was based on this description.

Lepadogaster zebrina Lowe

dogaster zebrinus Lowe, 1839, p. 88 (Madeira).
dogaster lepadogaster (*non* Bonnaterre) Maul *in* Noronha and Sarmento, 1948, p. 158 (Madeira).

IAGNOSIS: A *Lepadogaster* with a well-developed, spatulate snout. rane of the dorsal and anal fins broadly connected to caudal fin. A e cirrus extends from posterior margin of the anterior nostril, and a ler projection is present on the anterior margin. Body only moderately essed, depth 5.0 (4.8-5.3) in standard length. Four (3-4) rows of tened papillae across width of disc region A; 4 across disc region B. al rays 17 (15-18), anal rays 10 (9-11), pectoral rays 21 (20-22), and al rays 12 (10-13).
ESCRIPTION: Caudal peduncle short, least depth 0.8 (0.7-0.9) in its th. Anus located close to anal fin origin and under 5th (4-6) dorsal Head moderately depressed, length 2.3 (2.2-2.4) and width 3.2 (3.0- in standard length. Snout in dorsal outline elongate and rounded, (3.0-3.3) in head. Posterior nostril above or just behind anterior of eye. Eight short, blunt rakers on third gill arch.
reatest diameter of eye 0.8 (0.7-0.9) in bony interorbital space and (5.1-6.7) in head. Upper attachment of gill membrane opposite 7th (6-9) oral ray. Upper attachment of axial dermal flap opposite 11th (12-13) oral ray. Dorsal-caudal distance forward extends well in front of upper oral base, and as much as halfway between this structure and posterior in of eye; postdorsal-caudal distance 3.7 (3.3-4.3) in dorsal length. th of disc 3.4 (3.2-3.6) in standard length; disc region C with 3 (3-4) of flattened papillae across its width. Maximum known size 54.0 mm. ndard length.
OLORATION: In alcohol, some specimens are devoid of coloration but most e retained a large amount of red. In addition, many specimens show a inite, almost vertical series of stripes on the sides of the body be- en the pectoral and caudal fins. There is sometimes a light-colored n the top of the head, with the open end facing the snout.
ELATIONSHIP: This species is close to *Lepadogaster lepadogaster* of the nland; it tends to have more characters in common with *L. l. lepadogas-* than with *L. l. purpurea*. It is easily separated from the mainland spe- s on the basis of its greater body depth.
MATERIAL EXAMINED: BM 1899.1.16; 1895.5.28; 1858.4.4; 1936.11.28; and 5.9.19; 29 specimens from Madeira. KZM (not numbered); five, from chal, Madeira. SU 18741; five, from Madeira.
RANGE: Madeira Islands.
REMARKS: Dr. G. E. Maul of the Museu Municipal do Funchal has stated, in rivate communication, that he believes this is the only Madeiran species. *etodon pellegrini* (Chabanaud) and *Lepadogaster candollei* Risso have been orded from this island in the past.

Lepadogaster candollei Risso

Figure 76

Lepadogaster olivaceus Risso, 1810, p. 75 (Golfe de Saint-Hospice); 182
p. 274 (Golfe de Saint-Hospice).
Lepadogaster candolii Risso, 1810, p. 76 (Mer Saint-Hospice).—Lowe, 18
p. 190 (Madeira).—Günther, 1861, p. 513 (Mediterranean to Briti
coasts).—Moreau, 1881, p. 360, fig. 192 (Nice, Toulon, Port-Vendre
Golfe de Gascogne).—Carus, 1893, p. 690 (Malaga, Baleares, Puerto
Palma, Mahon, Alger, Port-Vendres, Toulon, Nizza, Livorno, Elu
Giannutri, Maddalena, Cagliari, S. Antioco, Gaeta, Napoli, Sicili
Palermo, Messina, Malta, Venezia, Trieste, Zaole, Spalato).—Ninn
1933, p. 27, pl. 5, 6.—Šoljan, 1948, p. 110, fig. 229, 230, 2
(Adriatic).
Lepadogaster jussieui Risso, 1826, p. 273 (Villefranche).
Lepadogaster decandollii Risso, 1826, p. 275 (Nice).—Day, 1880, p. 1
(Ireland, Cornwall, Channel Islands, France, Mediterranean).—Hoe
1914, p. 34 (middle coast of England, Ireland, Manche).—Jenkin
1936, p. 107 (Mediterranean to British Isles).—Antoniu, 1949, p.
(west coast of Black Sea).
Lepadogaster ottaviani Cocco, 1833, p. 243 (Messina).
Lepadogaster cephalus Thompson, 1839, p. 34 (Roundstone Bay, Connemar
Ireland).
Lepadogaster ruber Plucar, 1846, p. 25 (Trieste).
Lepadogaster adherens Bonaparte, 1846, p. 65 (Mediterranean).
Lepadogaster rafinesqui Costa, 1850, pl. 24, fig. 1-3.
Lepidogaster chupasangue Yarrell, 1859, p. 342 (*nomen nudum*).
Mirbelia decandollii Canestrini, 1864, p. 189, pl. 3, fig. 1, 3, 4, (San
degna, Palermo, Nizza).—Fraser-Brunner, 1938, p. 410 (British Isles

DIAGNOSIS: A *Lepadogaster* with a moderately developed, spatulate snou
Membrane of dorsal and anal fins not connected to caudal fin. A very sm
dermal flap on posterior margin of anterior nostril. Body well depresse
depth 5.7 (5.2-6.4) in standard length. Four (3-5) rows of flattened p
pillae across disc region A; 8 (7-9) rows across disc region B. Dorsal ra
15 (13-16), anal rays 10 (9-11), pectoral rays 28 (26-29), and caudal ra
12 (10-13).

DESCRIPTION: Caudal peduncle short, least depth 0.9 (0.8-1.0) in l
length. Anus located close to anal fin origin and under 3rd (2-4) dors
ray. Head moderately depressed, length 2.4 (2.2-2.6) and width 3.6 (3.
3.8) in standard length. Snout in dorsal outline somewhat elongate a
rounded, 3.4 (3.1-3.9) in head. Posterior nostril well behind anteri
edge of eye. Ten short, blunt rakers on third gill arch.

Greatest diameter of eye 0.9 (0.7-1.2) in bony interorbital space a
4.3 (3.8-5.6) in head. Upper attachment of gill membrane opposite 6
(5-7) pectoral ray. Upper attachment of axial dermal flap opposite 15
(13-17) pectoral ray. Dorsal-caudal distance forward extends at least
upper pectoral base, and sometimes as far as three-fourths of distance fr
this structure to posterior edge of eye; postdorsal-caudal distance 2
(2.4-3.4) in dorsal length. Length of disc 4.0 (3.8-4.3) in standa
length; disc region C with 3 (2-4) rows of flattened papillae across l
width. Maximum known size 75.0 mm. standard length.

COLORATION: In alcohol, most of the specimens are devoid of colorati
with the exception of a few which have some red pigment on the snout a
along the dorsal and anal fins. In life, the colors and patterns evident

e idely variable.
:LATIONSHIP: This well-defined species is easily separated from the n members of the genus. The differences, however, are not considered generic in scope (see discussion under the generic description).
.TERIAL EXAMINED: BM 1895.5.28; two specimens, from Salvage Islands. 4..12.1893; seven, from Messina, Sicily. TM (not numbered); two, from Yugoslavia. SU 1384; one, from Naples, Italy. USNM 48456; one, from Bay of Naples, Italy. GM (not numbered); one, from Gulf of Genoa, a'. MUT (not numbered); two, from west coast of Italy. IOM (not num-r); one, from Monaco. LM (not numbered); one, from the Mediterranean. :67.3.22 and 1845.6.22; two, from the Mediterranean. BM 1902.9.3; one, (north coast of France. BM (number not recorded); six, from Roscoff, ee. USNM 10104 and 10172; two, from Europe.
NGE: From Salvage Islands to the middle coast of England and through e Mediterranean to the Black Sea.
EMARKS: If the *rule of the first reviser* is followed in this case the e es name will remain *candollei*; otherwise it should be *olivacea*. [This has now been reinstated by the International Zoological Congress at nhagen—G. S. Myers, Editor].

Subfamily CHORISOCHISMINAE, new

ills three and one-half; gill membranes attached to isthmus; disc le. This subfamily is confined to South Africa. There is only one s.

Genus *CHORISOCHISMUS* Brisout de Barneville

Figures 22, 51; Map 6

isochismus Brisout de Barneville, 1846b, p. 209 (type species *Gobiesox nudus* (*non* Linnaeus) Brisout de Barneville, 1846, a misidentification of *Cyclopterus dentex* Pallas, 1769, by monotypy).
esox (*non* Lacépède) Müller and Troschel, 1849, p. 17 (type species *Gobiesox dentex* Cuvier, 1817 (a Latinization of Les Gobiesoces), by monotypy).
ena Castelnau, 1861, p. 72 (type species *Athaena fasciata* Castelnau, by monotypy).

ody well depressed anteriorly; head broad and rounded in dorsal outline snout only slightly produced. Nostrils on each side well separated distinctly tubular. Upper lip, as delineated by the premaxillary ve, about the same width at tip of snout as at sides.
eeth at front of each jaw large, conical, and slightly compressed with t tips; behind these a patch of very small, conical blunt teeth. Four shallow rakers on second gill arch. Edges of gill membranes attached rally close to pectoral base and just in front of upper origin of this No fleshy pad on lower pectoral base.
edian fins short but pectoral has a comparatively large number of rays. t dorsal and first pectoral rays may be quite small and easily overlooked casual examination. Disc large and pattern of flattened papillae entral surface unique (fig. 22).
ubopercular element present and is the terminal bone posteriorly on

head. It bears a strong spine. Pelvis has a characteristic shape fro ventral view (fig. 51). There are 6 branchiostegals, and 32 vertebrae

An externally apparent sexual dimorphism is found in the size of urogenital papilla, that of the male being much the larger.

The single known species in this genus is found along the southernm African shores.

Chorisochismus dentex (Pallas)

Cyclopterus dentex Pallas, 1769, p. 6, pl. 1.—Gmelin, 1788, p. 1475 (mari Americam australem"; in error).—Bonnaterre, 1788, p. 28(Mare du Nord," in error).—Walbaum, 1792, p. 486 ("Surinam"; in erro

Lepadogaster dentex Bloch and Schneider, 1801, p. 2 ("mari Americam a tralem"; in error).—Cuvier, 1817, p. 225.

Gobiesox gyrinus Valenciennes *in* Cuvier, 1836, pl. 108 (Des mers du Cap

Gobiesox nudus (*non* Linnaeus) Brisout de Barneville, 1846a, p. 144 (C "côte de Malabar", in error).

Chorisochismus nudus (*non* Linnaeus) Brisout de Barneville, 1846b, p. 2

Gobiesox dentex Müller and Troschel, 1849, p. 17.—Castelnau, 1861, p.

Gobiesox fimbriatus (*non* Müller and Troschel) Castelnau, 1861, p. (Camp's-bay).

Athaena fasciata Castelnau, 1861, p. 72 (Greenpoint).

Chorisochismus dentex Günther, 1861, p. 490 (Cape seas).—Kner, 1865-6 p. 237 (Cap der guten Hoffnung).—Barnard, 1927, p. 423 (Table Ba False Bay, Mossel Bay, Knysna).—Smith, 1949, p. 384 (Cape to Nata

Diplocrepis puniceus (*non* Richardson) Schmeltz, 1874, p. 31 (Mossel Ba Africa).

DIAGNOSIS: A very large clingfish which is reputed to attain a maxi length of about 300 mm. Head large in comparison to rest of body, leng 2.2 and width 2.5 (2.3-2.6) in standard length. Disc well developed, length 3.0 (2.8-3.2) in standard length. Dorsal rays 7 (6-9), anal ra 7 (6-7), pectoral rays 23 (23-24), and caudal rays 9 (8-10).

DESCRIPTION: Body robust and depressed, depth 4.5 (4.0-4.8) in stand length. Caudal peduncle medium, depth 1.4 (1.3-1.6) in its length. A located closer to rear margin of disc than to anal fin origin, and well front of dorsal origin. Snout in dorsal outline short and rounded, 3 (3.0-3.2) in head. Anterior nostril with a broad, simple, dermal flap tending from its posterior margin; posterior nostril in front of anter edge of eye. Eye 1.2 (1.0-1.3) in bony interorbital space and 4.8 (4.3-5 in head.

Upper attachment of gill membrane opposite 3rd (3-4) pectoral ray. Up attachment of axial dermal flap opposite 9th (8-10) pectoral ray. Dors caudal distance forward extends close to pectoral base; postdorsal-cau distance 1.0 (0.9-1.1) in dorsal length. Disc region A with 21 (18- rows of flattened papillae across its width; disc region B with 11 (10- rows across its width; 22 (19-24) rows across width of region C.

COLORATION: Alcohol specimens show a tendency to lose all colorati In life, the general body color is said to vary from olive to green to r dish.

RELATIONSHIP: A relict species with no known close relatives.

MATERIAL EXAMINED: SU 18729; two specimens from Table Bay, Capeto South Africa. USNM 16643; one, from Capetown, South Africa. USNM 1192 one, from Algoa Bay, South Africa.

RANGE: South Africa from Capetown to Natal.

Subfamily DIPLOCREPINAE, new

ills three; gill membranes united and free from isthmus; disc double. are seven genera and nine species; they are found from South Africa ie Indo-Pacific.

ARTIFICIAL KEY TO THE GENERA OF DIPLOCREPINAE

eep patches of large, rounded incisors at front of each jaw; a well-leveloped fleshy pad on lower pectoral base with a free posterior argin; a strong opercular spine.....*Diplocrepis* (p. 41)
f incisors present they are only in a single row; if a fleshy pad resent on lower pectoral base it is not well developed and has no free osterior margin; no opercular spine.
Teeth at front of each jaw a single row of incisors.....
.....*Pherallodus* (p. 43)
Teeth at front of each jaw in patches and conical in shape.
Disc very small, length 4.5-6.2 in standard length; body comparatively long and narrow, with 37-43 vertebrae.
a. No flattened papillae at center of disc in front of free anterior margin of region C (fig. 25); 5 rakers on second gill arch; a small, fleshy swelling on lower pectoral base.....*Gastroscyphus* (p. 45)
b. Flattened papillae at center of disc in front of free anterior margin of region C (figs. 25, 27); 6-8 rakers on second gill arch; no fleshy swelling on lower pectoral base.
a. Disc unusually narrow and elongate with a characteristic pattern of the flattened papillae (fig. 26); 8 rakers on second gill arch; body attenuate, with 42 vertebrae.....*Gastrocyathus* (p. 46)
b. Disc only slightly elongate with a different pattern of the flattened papillae (fig. 27); 6 rakers on second gill arch; body less attenuate, with 37 vertebrae.....*Parvicrepis* (p. 47)
Disc larger, length 3.2-4.0 in standard length; body comparatively short and broad, with 32-34 vertebrae.
a. No flattened papillae at center of disc in front of free anterior margin of region C (fig. 28); dorsal rays 7-10.....
.....*Aspasmogaster* (p. 49)
b. Flattened papillae at center of disc in front of free anterior margin of region C (fig. 29); dorsal rays 5-6.....
.....*Cochleoceps* (p. 51)

Genus *DIPLOCREPIS* Günther

Figures 23, 52; Map 7

crepis Günther, 1861, p. 506 (type species *Lepadogaster puniceus* Richardson, 1846, by monotypy).

dy broad and well depressed anteriorly; head very broad and rounded, snout a little produced. Nostrils on each side well separated and

distinctly tubular. Upper lip narrow, and about the same width all the
around snout.

Teeth large rounded incisors, occurring in deep patches toward front
each jaw; largest teeth in outer row, becoming smaller toward sides
jaws. Eight blunt, shallow rakers on second gill arch. Edges of gi
memorane attached laterally well in front of upper pectoral base a
slightly below upper origin of this fin. A well-developed, fleshy pad
lower pectoral base, with a short, free posterior margin.

Dorsal fin medium in length but anal very short. Anal and caudal cou
can be taken readily, but first dorsal and first pectoral rays very sm
and apt to be overlooked. Disc very large with a characteristic extern
structure (fig. 23). A small, central patch of flattened papillae can
seen between disc regions A and C.

Subopercular element has been lost, leaving the opercle as the termin
bone posteriorly on side of head. It bears a strong, non-pungent spin
Both pelvis and the distal postcleithral bones have a characteristic sh
from a ventral view (fig. 52). Vertebrae 33, and branchiostegals 6.

Except for size and coloration, there seems to be no externally appa
ent sexual dimorphism. Graham (1953, p. 366) has remarked that the adu
males are considerably smaller than the females. He also described t
sexual differences in coloration (quoted in the specific description).

This is a monotypic genus confined to New Zealand.

Diplocrepis puniceus (Richardson)

Lepadogaster puniceus Richardson, 1846, p. 71, pl. 43, figs. 1-7 (N
Zealand).

Diplocrepis puniceus Günther, 1861, p. 506 (New Zealand).—Hutton, 187
p. 40 (New Zealand).—Sherrin, 1886, p. 303 (New Zealand).—Hutto
1904, p. 47 (New Zealand).—Rendahl, 1925, p. 8 (Mahia Peninsul
Island Bay, Wellington).—Graham, 1953, p. 365 (Harrington Poin
life history).

DIAGNOSIS: A large, distinctive clingfish with a large disc and a ve
small anal fin. Dorsal rays 11 (10-11), anal rays 5 (4-5), pectoral ra
23 (23-24), and caudal rays 10.

DESCRIPTION: Body broad and well depressed anteriorly, depth 4.7 (4.
5.2) in standard length. Caudal peduncle medium, depth 1.2 (1.0-1.3)
its length. Anus located much closer to rear margin of disc than to orig
of anal fin. Head large and well depressed, length 2.3 (2.2-2.3) and wid
2.2 (2.2-2.3) in standard length. Snout short and rounded in dorsal ou
line, 4.3 (4.0-4.7) in head. Anterior nostril with a broad, simple derm
flap extending from its posterior margin; posterior nostril located just
front of anterior edge of eye. Eye 0.6 (0.5-0.7) in bony interorbit
space and 4.1 (4.0-4.3) in head.

Upper attachment of gill membrane opposite 6th (5-7) pectoral ray.
prominent fleshy pad on lowest portion of outer pectoral base, the fr
posterior margin extending dorsally as far as the 15th (14-15) pector
ray. Upper attachment of axial dermal flap opposite 8th (7-10) pector
ray. Postdorsal-caudal distance in dorsal length 1.4 (1.3-1.6); dorsa
caudal distance forward extends to distal one-half of pectoral fin. Di
length 2.3 (2.2-2.4) in standard length; disc region A with 9 (8-11) ro
of flattened papillae across its width; disc region B with 10 (7-11) ro
across its width; 7 (6-8) rows across width of disc region C. Maxim
known size about 100.0 mm. standard length.

COLORATION: The available preserved specimens had lost all coloratio

best account of the life color has been given by Graham (1953, p. 367); females are usually of a rose pink on the uppersurface and yellowish the undersurface, but the males develop a variety of tints before and ng courtship. I have seen males of many colours, olive-green shading rown, grey with darker lines, tinged with red, yellowish, or pale lilac e, and black on the sides. I have collected red ones with pale and stripes running longitudinally. In different situations, especially e protecting their eggs, they are seen coloured in endless variety, definitely striped, some spotted and others blotched and barred."

ELATIONSHIP: An evolutionary relict, not close to any other known spe-

ATERIAL EXAMINED: SU 47673; seven specimens from Lyall Bay, Wellington, Zealand. UMMZ 160887; one, also from Wellington. BM 1848.3.18.255; (holotype of *Lepadogaster puniceus*) from New Zealand.

ANGE: Cook Strait to Mahia Peninsula, New Zealand.

Genus *PHERALLODUS*, new

Map 6

ype species: *Crepidogaster indicus* Weber, 1913.

ery small fishes with a slender body, rounded or a little depressed riorly, and compressed posteriorly. Head slender and well depressed, a short rounded snout that is only slightly produced in dorsal outline. length 2.7-3.3 and width 3.9-5.4 in standard length. Nostrils on each well separated and distinctly tubular. Upper lip comparatively narrow, in one species, *P. smithi*, slightly wider at sides of snout than at it.

A single row of compressed, incisor-like teeth in each jaw. In *P. hi* tips of teeth uniformly rounded while in *P. indicus* those at front aws pointed and those at sides notched and pointed, with a shape similar hat illustrated (fig. 71) for the genus *Lepadichthys*. In upper jaw points of these peculiar lateral teeth project backward, while in lower they extend in the opposite direction. Six shallow rakers on second arch. Edges of gill membranes attached laterally, close to pectoral and well below upper origin of pectoral fin. No fleshy pad on lower oral base.

Median fins are comparatively short; dorsal rays 8-9, anal rays 5-7, caudal rays 9-11. Pectoral rays vary only from 22-23. Although the sal ray counts can be taken readily, the first anal and pectoral rays quite small and easily overlooked. External structure of disc not distive (fig. 24) but nevertheless useful in determination of generic inity. In *P. indicus* disc region C is considerably more narrow than of *P. smithi* (the species illustrated, fig. 86).

Subopercular element apparently present, and is the terminal bone postorly on side of head. It has no spine. Both pelvis and distal postithral bones distinctive in shape (fig. 53); the latter structures are ied closely to enlarged posterior portion of pelvis. Anterior portions the paired premaxillaries perforated by a narrow median opening (fig.

There are 33 vertebrae, and 6 branchiostegals.

The life colors have been observed only in *P. indicus*.

No external sexual dimorphism was evident in the few specimens available examination.

The two known species range from South East Africa to the outer Indoific (Tuamotu Archipelago). The name is from the Greek *phero*, to bear; os, different; and *odous*, a tooth.

Artificial Key to the Species of *Pherallodus*

1a. Disc large, length 3.7 in standard length; upper attachment of gil membrane opposite 5th pectoral ray; incisors at sides of jaws wit rounded tips.....*smithi* (p. 44
1b. Disc smaller, length 5.6-6.7 in standard length; upper attachment o gill membrane opposite 9th to 10th pectoral ray; incisors at sides o jaws notched with pointed tips.....*indicus* (p. 44

Pherallodus smithi, new species

Figures 24, 86

DIAGNOSIS: A *Pherallodus* with a comparatively large disc, length 3.7 i standard length. Upper attachment of gill membrane opposite 5th pectora ray. Dorsal rays 8, anal rays 6, pectoral rays 23, and caudal rays 9.

DESCRIPTION: Body small, fairly slender and depressed, depth 5.7 i standard length. Caudal peduncle medium, its depth 1.3 in its length Anus located a little closer to origin of anal fin than to rear margin o disc. Head medium sized and depressed, length 2.7 and width 3.9 in stand ard length. Snout short and rounded in dorsal outline 3.9 in head. An terior nostril with rear margin elevated, but lacking a well-defined derma flap; not laterally compressed. Posterior nostril located directly abov anterior edge of eye. Eye 0.8 in bony interorbital space and 3.9 in head.

Upper attachment of axial dermal flap opposite 5th pectoral ray. Dorsal caudal distance forward extends to tip of pectoral fin; postdorsal-cauda distance in dorsal length 1.2. Disc region A with 4 rows of flattene papillae across its width; disc region B also with 4 rows across its width region C with 2 rows across its width (fig. 24).

COLORATION: Unfortunately, the single specimen has no coloration re maining after its 20 years in alcohol.

RELATIONSHIP: As can be noted from the characters listed in the key this specimen represents a well-defined species even though it is now know only from the holotype.

HOLOTYPE: Stanford University number 31349; 18.8 mm. in standard length collected by Dr. Albert W. Herre at Durban, Natal, South Africa, on May 8 1934.

DERIVATION OF NAME: This new species is named for Dr. J. L. B. Smith o Rhodes University, Grahamstown, South Africa, who kindly sent to the autho some rare specimens of clingfishes. It is fitting that this African specie be named after one who has contributed so much to the ichthyology of th area.

Pherallodus indicus (Weber)

Figures 53, 77

Crepidogaster indicus Weber, 1913, p. 525, fig. 111 (Sanana, Insel Sul Besi; Muraras Reef example referred to *Lepadichthys minor*).

DIAGNOSIS: A *Pherallodus* with a comparatively small disc, its lengt 6.3 (5.6-6.7) in standard length. Upper attachment of gill membrane oppo site 9th (9-10) pectoral ray. Dorsal rays 8 (8-9), anal rays 6 (5-7) pectoral rays 23 (22-23), and caudal rays 10 (10-11).

DESCRIPTION: Body small, slender, and compressed posteriorly, depth 7. (6.8-7.3) in standard length. Caudal peduncle medium, its depth 1.4 (1.4

5 in its length. Anus much closer to origin of anal fin than to rear
n of disc. Head narrow and depressed, length 3.2 (3.1-3.3) and width
3 5.1-5.4) in standard length. Snout 3.5 (3.4-3.7) in head. Anterior
s il a simple, laterally compressed structure, without a dermal flap on
e argin; posterior nostril behind anterior edge of eye. Eye 0.6 in bony
t orbital space and 3.8 (3.7-4.0) in head.
per attachment of axial dermal flap opposite 9th (8-10) pectoral ray.
al-caudal distance forward extends to a point behind pectoral fin;
s orsal-caudal distance in dorsal length 3.6 (3.2-3.8). Disc region A
t ut any flattened papillae in its center; disc region B with 5 rows of
ened papillae across its width; region C with 1 row across its width
1 24). Maximum known size 17.7 mm. standard length.
OLORATION: No coloration remains in any of the alcohol specimens.
r (1913, p. 526) gives a brief account of the color of his freshly
erved material. The ground color was yellowish with a chalk-white
e extending along the back from the tip of the snout, becoming in-
inct posteriorly. There were indications of faint, broad stripes behind
under the eye. The region between the eye and the tip of the snout
pink.
ELATIONSHIP: This interesting little fish is easily distinguished from
only other member of the genus, a South African form.
ATERIAL EXAMINED: SU 47683; one specimen from Raroia Atoll, Tuamotu
cipelago. AM (not numbered); one, from Malikaba Bay, Soemba (Sumba)
nd, Lesser Sunda Islands. AM (not numbered); three (holotype (lecto-
) and two paratypes of *Crepidogaster indicus*), from Sanana Island,
a (Sula) Island Group.
ANGE: Tuamotu Archipelago west to the Lesser Sunda Islands and north to
Soela Islands.
EMARKS: Weber based his description of *indicus* on four examples (syn-
s) in the Amsterdam Museum. One of them, from Muaras Reef, is generic-
distinct from the others and is described below as a new species,
dichthys minor (which see). The three other examples, from Sanana, be-
to the present species, and one of them has been designated above as
otype of *indicus*. Weber states that his figure of *indicus* was taken
the specimen from Muaras Reef (Station 91). I have examined all four
imens and the figure is certainly taken, not from the Muaras Reef ex-
e, but from one of the specimens of *indicus* from Sanana.

Genus *GASTROSCYPHUS*, new

Figures 6, 25, 54; Map 7

ype species: *Crepidogaster hectoris* Günther, 1876.
Body slender and highly compressed posteriorly; head narrow and de-
sed with a short, broad snout. Nostrils on each side well separated and
inctly tubular. Upper lip broad, retrorse, a little wider at sides of
t than at front.
Teeth small, blunt and conical, in shallow patches toward front of each
these reduced to a single row posteriorly along sides of jaws. Five
t, blunt rakers on second gill arch. Edges of gill membranes attached
rally just in front of upper pectoral base and below upper origin of
fin. A small, fleshy swelling present on lowest part of pectoral base,
never a well-developed pad.
All fins fairly short. Ray counts of median fins can be taken readily,
first pectoral ray very small and apt to be overlooked. Disc very small
narrow with a characteristic external structure (fig. 25).
Subopercular element present, forming the terminal bone posteriorly on

side of head. It has no spine. Both pelvis and distal postcleithral bon have a characteristic shape from a ventral view (fig. 54). There are vertebrae (an unusually large number), and 6 branchiostegals.

The urogenital papilla of the male is several times larger than that a female of comparable size and, differs in shape (fig. 6).

This is a monotypic genus confined to New Zealand. The name is fr the Greek *gaster*, belly; and *skuphos*, a cup.

Gastroscyphus hectoris (Günther)

Crepidogaster hectoris Günther, 1876, p. 396 (south shore of Cook Strait 1877, p. 471 (south shore of Cook Strait).

DIAGNOSIS: A slender clingfish with posterior part of body highly com pressed. Dorsal fin almost directly above anal; the two of about equa size. Dorsal rays 7 (6-8), anal rays 7 (6-7), pectoral rays 21 (20-22), a caudal rays 8.

DESCRIPTION: Body slender, depth 7.3 (6.7-7.9) in standard length Caudal peduncle long, depth 2.7 (2.0-3.2) in its length. Anus closer t rear margin of disc than to origin of anal fin. Head slender and depresse anteriorly, length 3.4 (3.3-3.6) and width 5.3 (4.8-5.4) in standard length Snout short and broadly rounded, 3.5 (3.2-3.7) in head. Anterior nostri with a broad, shallow, simple dermal flap extending from its posterio margin; posterior nostril located behind or above anterior edge of eye Eye 0.9 (0.8-1.2) in bony interorbital space and 4.0 (3.7-4.3) in head.

Upper attachment of gill membrane opposite 3rd (2-4) pectoral ray Upper attachment of axial dermal flap opposite 16th (15-16) pectoral ray Postdorsal-caudal distance in dorsal length 0.5 (0.4-0.6); dorsal-cauda distance forward extends to a point behind tip of pectoral fin. Disc small length 5.8 (5.4-6.2) in standard length; no flattened papillae in centra portion of disc region A; disc region B with 3 (3-4) rows of flattene papillae across its width; 3 (3-4) rows across width of disc region C Maximum known size 43.6 mm. standard length.

COLORATION: No coloration was apparent in the alcohol specimens, bu Günther (1876, p. 396) states the color is red.

RELATIONSHIP: A highly distinct, probably relict, species; not close t any other known form.

MATERIAL EXAMINED: SU 47677; three specimens from Island Bay, New Zea land. SU 47676; nine, from Lyall Bay, Wellington, New Zealand. BM 1876.2 12.16; one (holotype of *Crepidogaster hectoris*), from the south side o Cook Strait, New Zealand.

RANGE: Vicinity of Cook Strait, New Zealand.

Genus *GASTROCYATHUS*, new

Figures 26, 55; Map 7

Type species: *Gastrocyathus gracilis*, new species.

Body very slender and depressed anteriorly; head very narrow with lon snout and inferior mouth. Nostrils on each side well separated and dis tinctly tubular. Upper lip broad, retrorse, widest at sides of snout.

Teeth small, conical, in deep patches toward front of jaw; largest teet in outer row, becoming recurved toward sides of jaws. Eight short, pointe rakers on second gill arch. Edges of gill membrane attached laterally wel in front of upper pectoral base and well below upper origin of fin. N fleshy pad present on lower pectoral base.

All fins comparatively short. Caudal count can be taken readily, bu

st pectoral ray and the last dorsal and anal rays very small and apt to overlooked. Disc small and narrow with a characteristic external structre (fig. 26).

Subopercular element is present, forming the terminal bone posteriorly side of head. It has no spine. Both pelvis and distal postcleithral es have a characteristic shape from a ventral view (fig. 55). Two adional bony elements appear just posterior to the distal postcleithral es. These have not been found in any other clingfish; their homology not at all clear. There are 42 vertebrae (an unusually large number), 6 branchiostegals.

There is no externally apparent sexual dimorphism in the preserved specns available for study.

This is a monotypic genus confined to New Zealand. The name is from the ek *gaster*, belly; and *kuathos*, a cup.

Gastrocyathus gracilis, new species

Figure 87

DIAGNOSIS: A small, slender clingfish with a markedly inferior mouth and ong, narrow caudal peduncle. Dorsal rays 6 (5-6), anal rays 6 (5-7), toral rays 19 (18-19), and caudal rays 8.

DESCRIPTION: Body slender and depressed anteriorly, depth 9.3 (8.7-10.1) standard length. Caudal peduncle long, depth 6.0 (4.6-7.8) in its gth. Anus located slightly closer to rear margin of disc than to origin anal fin. Head slender and well depressed, length 3.2 (3.1-3.3) and ith 5.4 (4.9-6.6) in standard length. Snout fleshy and projects well ond upper jaw, 3.0 (2.8-3.1) in head. Anterior nostril without a dermal ap extending from its margin; posterior nostril located just in front of erior edge of eye. Eye 0.8 (0.8-0.9) in bony interorbital space and 4.0 7-4.5) in head.

Upper attachment of gill membrane opposite 5th (4-5) pectoral ray. Upper achment of axial dermal flap opposite 12th (11-13) pectoral ray. Postrsal-caudal distance 0.4 (0.3-0.5) in dorsal length; dorsal-caudal stance measured forward reaches tip of pectoral fin. Disc length 4.7 .5-4.8) in standard length; no shallow, flattened papillae in central rt of disc region A; disc region B with 2 rows of flattened papillae ross its width; region C also with 2 rows across its width.

COLORATION: All coloration had been lost from the specimens examined.

RELATIONSHIP: A peculiar species, the only known member of its genus.

HOLOTYPE: Dominion Museum, Wellington, number 1576; 26.7 mm. in standard gth, collected by J. M. Moreland, at Island Bay, New Zealand, on April 1951.

PARATYPES: DM 1577; six specimens, 18.5 to 31.0 mm. in standard length, llected by R. K. Dell and J. M. Moreland, at Lyall Bay, Wellington, New aland, on March 19, 1950. SU 47674; one, 28.1 mm. in standard length, so from Lyall Bay, collected on July 16, 1949. SU 47675; two, 21.6 and .8 mm. in standard length, collected by R. K. Dell and J. M. Moreland, at all Bay, on July 30, 1949.

DERIVATION OF NAME: From the Latin *gracilis*, slender, or thin.

Genus *PARVICREPIS* Whitley

Figures 27, 56; Map 8

rvicrepis Whitley, 1931, p. 325 (type species *Diplocrepis parvipinnis* Waite, 1906, by original designation).

Body small and slender, compressed posteriorly and rounded anteriorly.

Head narrow with a short, rounded snout scarcely produced in dorsal outlin Upper lip narrow, about same width at front of snout as sides. Nostrils each side well separated and distinctly tubular.

Both jaws with a deep patch of sharp, conical teeth toward front; beco ing reduced to a single row along sides of jaws; teeth at corners of mou the largest and recurved. Six very shallow, rounded rakers on second gi arch. Edges of gill membranes attached a short distance in front of pe toral base, and just below upper origin of pectoral fin. No fleshy swelli or pad on lowest part of pectoral base.

Dorsal and anal fins both short; usually rays can be counted easily, b first pectoral ray very small and may be overlooked. Disc small and round with a distinct pattern of flattened papillae on ventral surface (fig. 27

Subopercular element present and forms the terminal bone posteriorly side of head. It bears no spine. Pelvis and distal postcleithral bon characteristic in shape from a ventral view (fig. 56). There are 37 ve tebrae, and 5 or 6 branchiostegals.

The sexual dimorphism is very evident in an adult breeding populatio The bodies of the gravid females become conspicuously swollen and t urogenital papilla of the male becomes very large and projects forwa (fig. 7).

This is a monotypic genus confined to Australia.

Parvicrepis parvipinnis (Waite)

Figure 7

Diplocrepis parvipinnis Waite, 1906, p. 202, pl. 36, fig. 3 (New Sou Wales); 1923, p. 207, fig.—McCulloch, 1929, p. 360 (New South Wales 1934, p. 96, pl. 37, fig. 354b.
Parvicrepis parvipinnis Whitley, 1931, p. 325.—Scott, 1936, p. 119.

DIAGNOSIS: A small, slender clingfish with a long caudal peduncle, t depth of this structure 2.7 (2.5-3.0) in its length. No flattened papill in disc region A. Dorsal rays 5 (4-5), anal rays 5 (4-5), pectoral rays (19-21), and caudal rays 8 (8-9).

DESCRIPTION: Body very slender and only slightly depressed, depth 6 (5.8-7.2) in standard length. Anus located much closer to anal fin orig than to rear margin of disc. Head narrow and moderately depressed, leng 3.0 (2.8-3.2) and width 5.0 (4.3-5.7) in standard length. Snout in dors outline medium and rounded, 3.3 (3.1-3.7) in head. Anterior nostril pr vided with a simple, narrow, dermal flap extending from its posteri margin; posterior nostril located directly above anterior edge of eye. E 0.8 in bony interorbital space and 3.7 (3.5-4.0) in head.

Upper attachment of gill membrane opposite 5th (4-6) pectoral ra Upper attachment of axial dermal flap opposite 9th (8-10) pectoral ra Postdorsal-caudal distance in dorsal length 0.3 (0.3-0.4); dorsal-caud distance forward extends to a point behind tip of pectoral fin. Dis length 5.3 (4.9-5.7) in standard length; disc region B with 3 (3-4) rows flattened papillae across its width; disc region C also with 3 (3-4) ro across its width. Maximum known size 21.0 mm. standard length.

COLORATION: The coloration has all faded out of the specimens availab for examination. However, in the original description, Waite (1906, p. 20 gives the following observation: "In life, olive green, uniform, or wi brown spots on the body, arranged as bands, or with bands fully defin which are four in number; a brown or red mark on the side of the snou through the eye to the preopercle."

RELATIONSHIP: A distinctive little fish, the only known member of it genus.

MATERIAL EXAMINED: SU 47682; seven specimens from Ulladulla, N. S. W., ustralia. SU 22248; eight, from Long Bay near Sydney, N. S. W., Australia. SU 22247; one, also from Long Bay. AuM 17708; five (syntypes of *Diplocrepis ovipinnis*), from New South Wales, Australia.
RANGE: Ulladulla to Sydney, New South Wales, Australia.

Genus *ASPASMOGASTER* Waite

Figures 28, 57; Map 8

Crepidogaster Günther, 1861, p. 507 (type species *Crepidogaster tasmaniensis* Günther, 1861, by subsequent designation of Jordan, 1919c, p. 307; preoccupied by *Crepidogaster* Boheman, 1848; Coleoptera).

Aspasmogaster Waite, 1907, p. 315 (no species mentioned, substitute name for *Crepidogaster* Günther, preoccupied; it therefore automatically takes the same generic type).

Diplocrepis (a subgenus) Whitley, 1931, p. 325 (type species *Diplocrepis costatus* Ogilby, 1885, by original designation; given full generic status by Whitley, 1935, p. 292).

Body medium in width and depressed anteriorly; head comparatively slender with short, rounded snout somewhat produced in dorsal outline. Head length 2.6-3.2, and width 3.8-4.4 in standard length. Nostrils on each side well separated and distinctly tubular. Upper lip comparatively narrow and may be slightly wider at sides of snout than at front.

A deep patch of slender, sharp, conical teeth at front of each jaw, reduced to a single row of larger, recurved teeth along sides of jaws. Eight to 9 small blunt rakers on second gill arch. Edges of gill membranes attached laterally just in front of pectoral base a little below upper origin of pectoral fin. No fleshy pad on lower pectoral base.

Unpaired fins medium in length; dorsal rays 7-10, anal rays 6-9, and caudal rays 10-12. Pectoral rays vary from 21-27. Usually rays in median fins can be counted easily, but first pectoral ray very small and apt to be overlooked. External structural pattern of disc (fig. 28), although not specific, is an aid to generic identification. There are 32 vertebrae, and 6 branchiostegals.

Subopercular element present and is the terminal bone posteriorly on side of head. It has no spine. Both pelvis and distal postcleithral bones characteristic in shape (fig. 57), posterior end of former being noticeably enlarged.

The coloration of live and freshly preserved specimens has been recorded for *A. tasmaniensis* but is unknown for *A. liorhynchus*. Consequently it is not known if color would provide a reliable basis for the identification of fresh material.

There is no externally apparent sexual dimorphism.

There are two known species ranging from Tasmania and Australia north to Lord Howe Island.

Artificial Key to the Species of *Aspasmogaster*

a. An accessory fold of tissue extending across top of snout just behind upper lip; pectoral rays 25 (24-27); postdorsal-caudal distance in dorsal length 1.7 (1.5-1.8).....*tasmaniensis* (p. 50)

b. No accessory fold of tissue across top of snout; pectoral rays 22 (21-23); postdorsal-caudal distance in dorsal length 1.2 (1.1-1.4).....*liorhynchus* (p. 51)

Aspasmogaster tasmaniensis (Günther)

Crepidogaster tasmaniensis Günther, 1861, p. 507 (Van Diemen's Land —Kner, 1865-67, p. 277 (Sydney).

Aspasmogaster tasmaniensis Waite, 1923, p. 206 (Tasmania and South Australia). —McCulloch, 1929, p. 359 (Tasmania; New South Wales?). —Scott 1936, p. 119, fig. 2 (Low Head, Tasmania).

Diplocrepis costatus Ogilby, 1885, p. iii (*nomen nudum*); 1885 (5 weeks later), p. 270 (Shark Reef, Port Jackson, New South Wales). —Waite 1904, p. 179, pl. 24, fig. 1 (Lord Howe Island); 1906, p. 203 (Victoria); 1923, p. 207, fig. (New South Wales, Victoria and South Australia). —McCulloch, 1929, p. 360 (in part; South Australia, Victoria, New South Wales, Lord Howe Island; New Caledonia record excluded).

Volgiolus costatus Whitley, 1935, p. 292, fig. —Scott, 1936, p. 119.

Volgiolus interorbitalis Whitley, 1943, p. 141 (Albany, King George Sound, Western Australia); 1948, p. 28 (Western Australia).

Aspasmogaster patella Scott, 1954, p. 111, fig. 3 (Kingston Park, South Australia).

DIAGNOSIS: An *Aspasmogaster* with an accessory fold of tissue behind upp lip. Postdorsal-caudal distance in dorsal length 1.7 (1.5-1.8). Dors rays 9 (8-10), anal rays 8 (7-9), pectoral rays 25 (24-27), and caudal ra 11 (11-12).

DESCRIPTION: Body slender and moderately depressed, depth 6.0 (5.7-6. in standard length. Caudal peduncle medium, its depth 1.2 (1.1-1.2) in l length. Anus located closer to origin of anal fin than to rear margin disc. Head well depressed, length 2.7 (2.6-2.8) and width 3.9 (3.8-4.1) standard length. Snout in dorsal outline medium and rounded, 3.6 (3.5-3. in head. Anterior nostril provided with a large, simple, dermal fl extending from its posterior margin; posterior nostril located above behind anterior edge of eye. Eye 0.7 (0.6-0.7) in bony interorbital spa and 4.0 (3.2-4.4) in head.

Upper attachment of gill membrane opposite 3rd (2-5) pectoral ra Upper attachment of axial dermal flap opposite 11th (9-12) pectoral ra Dorsal-caudal distance measured forward extends to a point behind tip pectoral fin. Disc length 3.5 (3.4-3.7) in standard length; disc region with 5 (4-6) rows of flattened papillae across its width; disc region with 7 (6-8) rows across its width; region C with 4 rows across its widt Maximum known size 62.0 mm. standard length.

COLORATION: All coloration becomes lost after several years preservati in alcohol. Scott (1936, p. 121) has given some data on the live a freshly preserved specimens. He received information from the collect that the fish were dark green with brown markings when first found. Wh examined shortly after their preservation in formalin, he found the spe imens exhibited a striking color pattern, comprising some fourteen vertic dark bars, which (except for the bar overlapped by the adpressed pectora which is twice as wide as its neighbors) are subequal in width to t interspaces of lighter ground color. After long preservation in formal they become a uniform dingy, very pale, pinkish yellow. Waite (1923, 207) says the color is a uniform pink, almost transparent during life.

RELATIONSHIP: A distinctive species with the accessory tissue flap acro the snout. This flap is supported by the anterior ends of the two nas bones, which are broad and flattened.

MATERIAL EXAMINED: BM 1852.1.5.41; one specimen (holotype of *Crepid gaster tasmaniensis*) from Van Diemen's Land (Tasmania). AuM B7140 a B7141; two (syntypes of *Diplocrepis costatus*), from Shark Reef, Port Jac

N. S. W. SU 9179; one, also from Port Jackson. AuM 1A695; three, Coogee, near Sydney, N. S. W. AuM 1A677; two (holotype of *Volgiolus orbitalis*, plus one paratype), from Albany, King George's Sound, West-Australia.

ANGE: Tasmania north to Sydney and Lord Howe Island, and west to King ge's Sound, Western Australia.

Aspasmogaster liorhynchus, new species

IAGNOSIS: An *Aspasmogaster* without an accessory fold of tissue across of snout, region behind premaxillary groove being smooth. Postdorsal-al distance in dorsal length 1.2 (1.1-1.4). Dorsal rays 7 (7-8), anal 7 (6-7), pectoral rays 22 (21-23), and caudal rays 11 (10-12).

ESCRIPTION: Body medium in width and moderately depressed, depth 6.0 -6.3) in standard length. Caudal peduncle medium, its depth 1.2 (1.1- in its length. Anus located either half way between rear margin of and origin of anal fin or else closer to the latter. Head well de-sed, length 2.9 (2.7-3.2) and width 4.3 (4.0-4.4) in standard length. t in dorsal outline medium and rounded, 3.4 (3.2-3.6) in head. Anterior ril provided with a large, simple, dermal flap which reaches to post-r nostril when depressed backward; posterior nostril located well nd anterior edge of eye. Eye 0.7 (0.6-0.8) in bony interorbital space 4.3 (3.7-4.8) in head.

Jpper attachment of gill membrane opposite 2nd (1-2) pectoral ray. r attachment of axial dermal flap opposite 7th (6-9) pectoral ray. al-caudal distance forward extends to a point behind tip of pectoral Disc length 3.8 (3.5-4.0) in standard length; disc region A with 6) rows of flattened papillae across its width; disc region B with 6 (5-ows across its width; region C with 3 rows across its width.

OLORATION: The alcohol specimens are all a pale yellow with no markings ining.

ELATIONSHIP: Although closely related to *A. tasmaniensis* in other ects, it does not possess the characteristic fold of tissue across the of the snout.

OLOTYPE: Australian Museum number 1A695; 40.8 mm. in standard length, a rock pool at Coogee, near Sydney, New South Wales, Australia, on mber 15, 1921. The name of the collector is not known.

ARATYPES: SU 47665; seven specimens, from 25.8 to 41.4 mm. in standard th, taken with the holotype. AuM 1A695; eight specimens, from 29.8 to mm. in standard length, also taken with the holotype. SU 47664; two, and 25.4 mm. in standard length, from Long Bay near Sydney, N. S. W., ralia, collected by A. R. McCulloch in April, 1907.

ERIVATION OF NAME: From the Greek *leios*, smooth; and *rhynchos*, snout.

Genus *COCHLEOCEPS* Whitley

Figure 29, Map 8

hleoceps Whitley, 1943, p. 141 (type species *Crepidogaster spatula* Günther, 1861, by original designation).

Body broad and well depressed anteriorly. Head long and broad, more or s triangular in dorsal outline, with medium, rounded snout. Upper lip paratively narrow and distinctly retrorse, wider at sides of snout than front.

Deep patches of small, pointed, conical teeth at front of each jaw, be-ing reduced to a single row of larger, recurved teeth along sides of

jaws. Seven short, blunt rakers on second gill arch. Edges of gill m branes attached close to pectoral base, below and slightly behind up origin of pectoral fin. No fleshy swelling or pad on lowest part of p toral base.

Dorsal and anal rays both short, but pectoral fin well developed, hav a large number of rays. Median fin rays can be counted easily, but fi pectoral ray very small and might be missed. Disc large and rounded wit characteristic pattern of the flattened papillae on ventral surface (f 29).

Subopercular element present and forms the terminal bone posteriorly side of head. It has no spine. Unfortunately it was not possible illustrate the pelvis and distal postcleithral bones in this genus; si specimens of the single known species are extremely rare, it was n possible to obtain one which could be cleared and stained. There are vertebrae, and 6 branchiostegals.

There was no externally evident sexual dimorphism in the materi available for study.

This is a monotypic genus confined to Tasmania and Australia.

Cochleoceps spatula (Günther)

Crepidogaster spatula Günther, 1861, p. 508 (Swan River, Western Australi —Waite, 1906, p. 201, pl. 36, fig. 4 (Victoria).

Aspasmogaster spatula Waite, 1923, p. 206, fig. (Western and South Au tralia and Victoria). —McCulloch, 1929, p. 359 (Victoria, West Australia). —Scott, 1936, p. 119.

Cochleoceps spatula Whitley, 1943, p. 141; 1948, p. 28 (Western Australi

DIAGNOSIS: A large, broad, clingfish without a fleshy pad on lower p toral base. Median fins short. Dorsal rays 6 (5-6), anal rays 6 (5- pectoral rays 26 (25-27), and caudal rays 10 (10-11).

DESCRIPTION: Body fairly broad and well depressed, depth 5.4 (4.9-6 in standard length. Caudal peduncle medium, depth 1.5 (1.3-1.7) in length. Anus located much closer to origin of anal fin than to rear mar of disc. Head broad and well depressed, length 2.4 (2.3-2.6) and width (2.8-3.8) in standard length. Snout in dorsal outline somewhat triangu and rounded at the end, 3.1 (2.9-3.3) in head. Anterior nostril wit narrow, simple flap which, when depressed backward, reaches the poster nostril; posterior nostril located above or just behind anterior edge eye. Eye 1.0 (0.7-1.2) in bony interorbital space and 4.4 (3.8-5.0) head.

Upper attachment of gill membrane opposite 5th (4-6) pectoral r Upper attachment of axial dermal flap opposite 13th (12-14) pectoral r Postdorsal-caudal distance in dorsal length 0.6 (0.6-0.7); dorsal-cau distance forward extends to tip of pectoral fin or just behind this poi Disc length 3.3 (3.2-3.6) in standard length; disc region A with 6 (4 rows of flattened papillae across its width; disc region B with 8 (7 rows across its width; 5 (4-6) rows across width of disc region C. Maxi known size 52.5 mm. standard length.

COLORATION: No coloration remained in the alcohol specimens availa for examination. Waite (1923, p. 206) reports the color to be yellow w the upper half ornamented with crowded carmine spots.

RELATIONSHIP: A distinctive fish, the only known member of its genus

MATERIAL EXAMINED: AuM I13005; one specimen from Wineglass Bay, Tasman AuM I7606; three, from Port Phillip, Victoria, Australia. KZM 5.10.19 one, from Port Western, Victoria.

RANGE: Wineglass Bay, Tasmania to Victoria, Australia, and west to S River, Western Australia.

Subfamily GOBIESOCINAE

B SOCINAE, Jordan and Evermann, 1898, p. 2327.

lls three; gill membranes united and free from isthmus; disc single. e are nine genera and 55 species. With the exception of one monotypic r (*Eckloniaichthys*) in South Africa, all members of this subfamily are d ned to the New World, and all New World clingfishes so far known be- n to this subfamily.

ARTIFICIAL KEY TO THE GENERA OF GOBIESOCINAE

nly teeth at front of upper jaw a single row of large incisors.
a. A well-developed fleshy pad on lower pectoral base with a free posterior margin; a large, heart-shaped mass of flattened papillae in disc region C (fig. 30); about 55 long narrow rakers on second and third gill arches.....*Sicyases* (p. 54)
b. Only a small fleshy swelling on lower pectoral base without a free posterior margin; no papillae in disc region C (fig. 31); 8-10 short rakers on second and third gill arches.....*Tomicodon* (p. 57)
. If incisors present at front of upper jaw they are in more than one row or with a patch of conical teeth.
a. Upper lip narrow, about same width at front of snout as at sides; lowest 5-7 rays of pectoral fin markedly reduced; disc small, length 4.6-6.7 in standard length.
a. A single row of teeth at front of upper jaw; 4 rakers on second gill arch; only a few large, flattened papillae on ventral disc surface in a characteristic pattern (fig. 32).....*Eckloniaichthys* (p. 71)
a. A patch of teeth at front of upper jaw; 5-7 rakers on second gill arch; many flattened papillae on ventral disc surface arranged in other patterns (figs. 33, 34).
a. Head comparatively large, length 2.7-3.1 in standard length; lower incisors with serrated tips; body fairly short with 25 vertebrae.....*Acyrtops* (p. 73)
b. Head smaller, length 3.4-4.0 in standard length; lower incisors with smooth tips; body longer with 35-36 vertebrae.....*Rimicola* (p. 75)
b. Upper lip broad, much wider at front of snout than at sides; lowest 5-7 rays of pectoral fin not markedly reduced; disc larger, length 2.3-4.1 in standard length.
a. A well-developed flattened fleshy pad on pectoral base with a free posterior margin.
a. The flattened papillae in disc region C in 2 closely approximated groups (fig. 35); bony disc supports with a characteristic shape (fig. 63).....*Arcos* (p. 81)
b. The flattened papillae in disc region C in 2 widely separated groups (fig. 36); bony disc supports with a characteristic shape (fig. 64).....*Gobiesox* (p. 87)
b. Fleshy pad on lower pectoral base poorly developed, at most small and rounded in shape, with no free posterior margin.
a. A patch of incisors at front of upper jaw; disc region A filled with flattened papillae; head broad, width 2.3-2.8 in standard length.....*Acyrtus* (p. 125)
b. A patch of conical teeth at front of upper jaw; no papillae in disc

region A; head narrow, width 3.2-3.6 in standard length.....
.....*Pherallodiscus* (p.

Genus *SICYASES* Müller and Troschel

Figures 8, 30, 58; Map 9

Sicyases Müller and Troschel, *in* Müller, 1843, pp. 297, 298 (type spe
Sicyases sanguineus Müller and Troschel, 1843, by monotypy).—Mü
and Troschel, 1849, p. 19.

Body moderately depressed anteriorly. Head triangular in dorsal out
with the blunt snout projecting a little in front; head well depress
length 2.3-3.2 and width 2.5-3.2 in standard length. A few shallow, fl
lobes beneath lower jaw but not elsewhere on head. Nostrils on each
well separated, distinctly tubular. Upper lip, as delineated by the
maxillary groove, wide at front of snout and narrowing rapidly at sides

Teeth at front of each jaw large rounded incisors, in a single
Those at front of upper jaw followed on each side by small canines.
lower jaw large incisors are followed on each side by 3 to 7 small canin
conical teeth. A few small, conical, palatine teeth on each side. Se
and third gill arches each bear numerous (about 55), narrow rakers, ir
ular in length and position.

Edges of gill membranes attached laterally a short distance in fron
upper pectoral base. A well-developed, fleshy pad on outer pectoral b
with a free posterior margin. Latter does not extend dorsally as fa
gill membrane attachment.

Vertical fins medium in length; dorsal rays 10-12, anal rays 7-9,
caudal rays 8. Pectoral rays range from 24-25. Usually first 2 rays
dorsal and anal fins much reduced, and not externally visible except
very small specimens in which fin membranes are thin and semi-transpare
For identification, when time for dissection or clearing and staining
not be spared, it is usually safe to add 2 to the external dorsal and
ray counts in this genus.

Disc fairly large, length 2.6-3.1 in standard length, with a char
teristic arrangement of the shallow, flattened papillae on its vent
surface (fig. 30). Bony support for disc also characteristic (fig. 5
Pelvic girdle comparatively broad and solid; the distal postcleithral b
have a unique shape.

The life color of the dorsal side of the body is apparently a mott
reddish-brown.

An external sexual dimorphism can be seen in the size and shape of
urogenital papilla (fig. 8). Vertebrae 34.

There are two known species in this genus, both confined to the south
part of the Eastern Pacific.

Artificial Key to the Species of *Sicyases*

1a. Head comparatively short, length 3.2 in standard length; anal rays
.....*brevirostris* (p.

1b. Head longer, length 2.7 (2.3-3.1) in standard length; anal ray
(7-8)[1].....*sanguineus* (p.

[1] If anal rays are counted without dissection, add 2 to the count.

Sicyases brevirostris (Guichenot)

sox brevirostris Guichenot *in* Gay, 1848, p. 335 (in part; specimen from Juan Fernández Island, Chile, only; it is not known whether the figure in Gay applies to this species or to the next).
ses hildebrandi Schultz, 1944, p. 61 (Cumberland Bay, Juan Fernández Island, Chile).—Briggs, 1951, p. 100 (Juan Fernández Island).

AGNOSIS: A large clingfish with a relatively short head, length 3.2 andard length. Dorsal rays 11, anal rays 9, pectoral rays 25, and l rays 8.
SCRIPTION: Body well depressed, depth 6.4 in standard length. Caudal cle medium, least depth 1.8 in its length. Anus located close to rear n of disc. Maximum known size 69.0 mm.
ad depressed, width 2.8 in standard length. Snout 3.1 in head. Both ils close in front of eye, the anterior with a small, fringed, dermal arising from its posterior margin. The 3 pairs of large incisors at of lower jaw followed on each side by 6 (5-7) small, conical teeth. pairs of large incisors at front of upper jaw followed on each side (1-3) small canines. Five small, conical palatine teeth on each side. eatest diameter of eye 1.5 in bony interorbital space and 4.3 in head. attachment of gill membrane opposite 8th pectoral ray. Subopercular well developed. Free posterior margin of fleshy pad on pectoral base nds dorsally as far as 11th pectoral ray. Upper attachment of axial al flap opposite 6th pectoral ray.
orsal-caudal distance measured forward extends to middle of postorbital h of head; postdorsal-caudal distance 1.2 in dorsal length. Length of 2.8 in standard length; disc region A with 3 rows of flattened pa-ae across its width; 4 rows across width of disc region B; 8 rows ss width of region C.
OLORATION: In alcohol, background yellowish-gray, peppered with black ent cells visible under magnification.
ELATIONSHIP: The species is quite close to *S. sanguineus*, the only r known species in the genus, and perhaps a subspecies of it.
ATERIAL EXAMINED: USNM 88818; one specimen (holotype of *Sicyases hilde-ii*), from Juan Fernández Island, Chile. MHNP A4922; one specimen (syn- (lectotype-holotype) of *Gobiesox brevirostris* Guichenot), also from Fernández.
ange: Juan Fernández Island, Chile.

Sicyases sanguineus Müller and Troschel

ases sanguineus Müller and Troschel, *in* Müller, 1843, p. 298, footnote. (Chile).—Müller and Troschel, 1849, p. 19, pl. 3, fig. 1 (Chile). —Günther, 1861, p. 494 (Chile, Valparaiso).—Delfin, 1901, p. 90 (Bahia de Concepción, Cavancha; Isla de Juan Fernández, Tome, Talcahuano).—Schultz, 1944, p. 61 (Peru and Chile).—Hildebrand, 1946, p. 492 (coasts of Peru and Chile).—Briggs, 1951, p. 99 (Concepción Bay, Chile, to Callao Bay, Peru).
esox brevirostris Guichenot, *in* Gay, 1848, p. 335, pl. 9, fig. 1 (in part; specimens from Valparaiso, Chile, only; for lectotype, see under *S. brevirostris*).
esox sanguineus Abbott, 1899, p. 363 (coasts of Peru and Chile).—Ever-

mann and Radcliffe, 1917, p. 153 (Peru and Chile).—Nichols and phy, 1922, p. 513 (Chincha Islands).—Fowler, 1945a, p. 267 (Cal Chincha Islands).

DIAGNOSIS: A very large clingfish with a comparatively long head, le 2.7 (2.3-3.1) in standard length. Dorsal rays 11 (10-12), anal ra (7-8), pectoral rays 25 (24-25), and caudal rays 8.

DESCRIPTION: Body moderately depressed, depth 5.7 (4.7-6.7) in stan length. Caudal peduncle medium, least depth 1.7 (1.3-2.0) in its len Anus located in front of dorsal origin and close to rear margin of d Maximum known size 216.0 mm. standard length.

Head depressed, width 2.8 (2.5-3.2) in standard length. Snout fla slightly concave in lateral outline, 3.2 (2.9-3.6) in head. Poste nostril above or slightly in front of anterior edge of eye; anterior tril with a fringed rim, and covered by a large, round, fringed dermal extending from the posterior margin. Three pairs of rounded incisor front of lower jaw, followed on each side by 5 (3-6) small canines. T pairs of rounded incisors at front of upper jaw, followed on each side (1-3) small canines. Four (2-5) small, conical, palatine teeth on side. Each gill arch bears about 55 narrow rakers, irregular in length position.

Characteristic fleshy, lobe-like structures present beneath lower Greatest diameter of eye 2.0 (1.1-3.2) in bony interorbital space (an ex sive change in size takes place in this organ during ontogeny, the diam being inversely proportional to the body length) and 5.7 (3.6-7.9) in h Upper attachment of gill membrane opposite the 9th (7-11) pectoral Subopercular spine well developed but not pungent. Fleshy pad on pect base conspicuous, with a free posterior margin extending from lowest of pectoral base dorsally as far as 11th (10-12) pectoral ray. Up attachment of axial dermal flap opposite 5th (4-6) pectoral ray.

Dorsal-caudal distance forward extends to a point in front of gill brane attachment and sometimes as far as three-fourths the distance this attachment to posterior edge of eye; postdorsal-caudal distance (0.8-1.2) in dorsal length. Length of disc 2.8 (2.6-3.1) in stand length; disc region A with 4 (3-5) rows of flattened papillae across width; 4 (3-4) rows across width of region B; 9 (8-10) rows across widt region C.

COLORATION: In alcohol, the dorsal side of the body is mottled w reddish-brown. From a dorsal view, three wide, dark cross-bars are ap ent in the region anterior to the dorsal fin. The rays in the dors pectoral, and caudal fins are red. In addition, two pale, vertical b can be seen on the caudal fin. The tips of the anal rays are also red, rest of the fin being very pale, and three red spots are present along distal edges of the ventrals. The ventral side of the body is an ev pale-green color.

RELATIONSHIP: There is but one other known species in this distinct genus. It seems to be quite closely related to this one.

MATERIAL EXAMINED: SU 18118 and 18119; 10 specimens from Valparai Chile. MHNP A4921 and A4923; two (syntypes of *Gobiesox brevirost* Guichenot), also from Valparaiso. SU 37557; one, from Independencia Peru. SU 37556 and 40876; five, from North Chincha Island, Peru. SU 6 three, from Callao Bay, Peru.

RANGE: Concepción Bay, Chile to Callao Bay, Peru.

REMARKS: The specific name *sanguineus* dates from 1843, and was no *nomen nudum* as of that date. Müller and Troschel (in Müller, 1843) bri described and characterized a new genus and species, *Sicyases sanguine* even though none of the characterization was given below the specific n

The very large North Chincha specimens at Stanford were on large bo

at a depth of six to 10 feet, and were speared by local fishermen un-
the direction of Prof. Myers.

Genus *TOMICODON* Brisout de Barneville

Figures 31, 59; Map 12

codon Brisout de Barneville, 1846a, p. 144 (type species *Tomicodon chilensis* Brisout de Barneville, 1846, by subsequent designation of Jordan, 1919c, p. 228).

:ciosa Jordan and Evermann, *in* Jordan, 1896, p. 230 (type species *Gobiesox humeralis* Gilbert, 1890, by original designation).

ody moderately depressed anteriorly; head somewhat triangular in dorsal ine with the snout projecting a little instead of being continuous with head. Head depressed, length 2.6-3.6 and width 3.1-5.5 in standard th. A few very shallow, fleshy lobes may appear beneath lower jaw but elsewhere on head. Nostrils on each side well separated, distinctly lar. Upper lip, as delineated by premaxillary groove, wide at front of t, narrowing rapidly at sides.

Dne row of teeth in each jaw; those at front strongly compressed in-rs, at least some with trifid tips, followed on each side by one or canines. Canines highly developed; some longer than the incisors in ts of all species except *T. eos*, where they are reduced (adults of *absitus* not seen).

Eight to 10 narrow, pointed rakers on each of the two posterior gill es. Gill membranes attached laterally very close to pectoral fin base. ry poorly developed fleshy pad on outer pectoral base without a free, ical, posterior margin.

Dorsal, anal, pectoral, and caudal fins quite short. Dorsal rays 6-9, rays 5-9, pectoral rays 17-23, and caudal rays 7-10. First 2 dorsal anal rays usually much reduced and not externally visible except on small specimens in which fin membranes are thin and semi-transparent. identification, when time for dissection or clearing and staining ot be spared, it is usually safe to add 2 to external dorsal and anal counts in this genus.

isc medium sized, length 3.2-4.5 in standard length, and with a charac-stic arrangement of the shallow, flattened papillae on its ventral sur- (fig. 31). Bony support of this structure unique (fig. 59). Pelvic le is comparatively narrow and long, and the distal postcleithral bones large with a characteristic shape. Vertebrae 29-33.

here was no externally apparent sexual dimorphism.

There are twelve known species and subspecies in the group, including e described as new in this paper.

This genus is confined entirely to the new world; two forms (subspe-cally distinct) are in the Western Atlantic and ten in the Eastern fic. None have been taken in fresh water.

Artificial Key to the Species of *Tomicodon*

More incisors present at front of upper jaw than at front of lower jaw. Pectoral rays 17-19; postdorsal-caudal distance 0.9-1.6 in dorsal length; a distinctive pattern of light diagonal stripes posteriorly on sides of body.....*humeralis* (p. 59)

Pectoral rays 19-23; postdorsal-caudal distance 0.5-0.9 in dorsal length; no light diagonal stripes posteriorly on sides of body.

3a. Papillae of inner row in central portion of disc region A noticea elongate, at least twice as long as the others; very little brown black on dorsum.

4a. Body only moderately depressed, depth 5.3-5.9 in standard leng head length 3.1 and width 3.3-4.0 in standard length..*myersi* (p.

4b. Body well depressed, depth 9.1 in standard length; head length and width 4.5 in standard length.....*vermiculatus* (p.

3b. Papillae of inner row in central portion of disc region A may longer than the others, but never twice as long; large areas of br or black pigment on dorsum.

5a. Height of dermal flap extending from margin of anterior nostril ab equal to distance between anterior and posterior nostrils; anus m closer to rear margin of disc than to anal fin origin; anterior e of eye extends in front of posterior nostril.....*zebra* (p.

5b. Height of dermal flap extending from margin of anterior nostril l than distance between anterior and posterior nostrils; anus usua closer to anal fin origin than to rear margin of disc; anterior e of eye usually below or behind posterior nostril.

6a. A prominent black spot almost always present on each side of mi body line a short distance above pectoral base; no dark-brown, v tical bars on sides extending on to the ventral surface of the a fin.

7a. Number of incisors in each jaw correlated with growth (4-7 pai in upper jaw; 3-4 pairs in lower); length of disc usually 3.6- in standard length; height of dermal flap extending from margin anterior nostril much greater than diameter of nostril; width head 3.6-4.3 in standard length.....*petersi* (p. 6

7b. Number of incisors in each jaw constant, and not correlated wi growth (4 pairs in upper jaw; 3 pairs in lower); length of di 3.3-3.7 in standard length; height of dermal flap extending fr margin of anterior nostril usually a little greater than diamet of nostril; width of head 3.4-3.9 in standard length.

8a. A pattern of elongate, blackish spots usually present along ea side of body; posterior nostril in front of anterior edge of ey 7 (6-8) rows of flattened papillae across width of disc region .....*boehlkei* (p. 6

8b. No pattern of elongate blackish spots along each side of bod posterior nostril above or slightly behind anterior edge of ey 5 (5-6) rows of flattened papillae across width of disc regi B.....*absitus* (p. 6

6b. No prominent black spot on each side of midbody line a short di tance above pectoral base; dark-brown, vertical bars on sides e tending onto ventral surface in region of anal fin.

9a. Length of disc 4.0-4.5 in standard length; dermal flap extendi from margin of anterior nostril minute or absent..... .....*fasciatus fasciatus* (p. 6

9b. Length of disc 3.5-3.9 in standard length; dermal flap extendi from margin of anterior nostril small, height about equal to dia eter of nostril.....*fasciatus australis* (p. 6

1b. An equal number of incisors present at front of each jaw.

10a. Anterior edge of eye behind posterior nostril; canines strong a longer than incisors; upper attachment of gill membrane opposi upper edge of pectoral fin; dorsal-caudal distance measured forwa does not extend as far as pectoral fin.....*chilensis* (p. 6

10b. Anterior edge of eye below or in front of posterior nostril; canin weak and shorter than incisors; upper attachment of gill membra opposite 3rd-5th pectoral ray; dorsal-caudal distance measured fo ward extends well up on pectoral fin.

.. Pectoral rays 22 (22-23); least depth caudal peduncle 1.3 (1.2-1.4) in its length; incisors of lower jaw followed on each side by 2 or 3 small canines.....*eos eos* (p. 69)
). Pectoral rays 21; least depth caudal peduncle 1.6 (1.5-1.7) in its length; incisors of lower jaw followed on each side by 5 small canines.....*eos rhadinus* (p. 70)

Tomicodon humeralis (Gilbert)

iesox humeralis Gilbert, 1890a, p. 95 (Puerto Refugio, Ángel Island). —Pellegrin, 1901a, p. 162 (Gulf of California).
ıciosa humeralis Jordan, 1896, p. 230, pl. 35.—Jordan and Evermann, 1896, p. 491 (Gulf of California); 1898, p. 2341 (Ángel Island, La Paz).—Osburn and Nichols, 1916, p. 177 (San Francisquito Bay).—Jordan, Evermann and Clark, 1930, p. 490 (Gulf of California).—Schultz, 1944, p. 58 (Gulf of California).—Briggs, 1951, p. 101 (from San Francisquito Bay, Baja California, Mexico, to Punta Peñasco, Sonora, Mexico).

DIAGNOSIS: A large *Tomicodon* with 5 to 7 pairs of trifid incisors in er jaw and 4 or 5 pairs in lower jaw. Anus much closer to anal fin gin than to rear margin of disc. Dermal flap extending from margin of erior nostril very small, height usually less than diameter of nostril. istinctive pattern of light diagonal stripes on posterior half of sides body. Dorsal rays 8 (8-9), anal rays 7 (6-7), pectoral rays 18 (17-19), caudal rays 10 (9-10).
DESCRIPTION: Body moderately depressed, depth 7.0 (6.3-7.7) in standard gth. Caudal peduncle medium, least depth 1.5 (1.4-1.8) in its length. imum known size 72.4 mm. standard length.
Head depressed, length 3.0 (2.8-3.3) and width 3.4 (3.1-3.7) in standard gth. Snout moderately shallow with a rounded outline, 3.3 (3.1-3.6) in d; posterior nostril in front of anterior edge of eye. Teeth at front upper jaw trifid incisors followed on each side by 2 to 4 well-developed ines. Teeth at front of lower jaw also trifid incisors, followed on each e by 3 or 4 well-developed canines.
Greatest diameter of eye 1.2 (0.9-1.4) in bony interorbital space and (4.3-5.8) in head. Subopercular spine poorly developed and hidden by vy skin of opercle region. Upper attachment of axial dermal flap osite 6th (5-7) pectoral ray.
Dorsal-caudal distance forward does not extend as far as tip of pectoral ; postdorsal-caudal distance 1.3 (0.9-1.6) in dorsal length. Length of 3.4 (3.2-3.6) in standard length; 6 (5-7) rows of flattened papillae oss width of disc region A; 7 (6-8) rows across width of disc region B.
COLORATION: In alcohol, the ground color of the dorsal and lateral sides a light gray. There are dark gray and blackish vermiculations on top of head and posteriorly as far as the origin of the dorsal fin. Two minent black spots can be seen on the dorsum, one on each side of the body line, a short distance above the base of the pectoral fin. The s have a light gray ground color while the ventral surface of the body very pale with no apparent pigment pattern.
RELATIONSHIP: I consider this species to be the most primitive in the us. It has more teeth in each jaw, a longer dorsal fin, more caudal s, fewer pectoral rays, and attains a larger size than any of the other cies. Its nearest relative is probably *T. boehlkei*, although the relanship is not very close.
MATERIAL EXAMINED: SU 36670; four specimens from southeast part of urón Island, Sonora, Mexico. SU 70; five (syntypes of *Gobiesox hum-*

eralis), from Puerto Refugio, Ángel Island, Baja Calif., Mexico. SU 1783 13, from Mejia Island, Baja Calif., Mexico. SU 17836; one, from Puert Libertad, Sonora, Mexico. SU 16374-16384; 123, from Punta Peñasco, Sonor Mexico.

RANGE: From San Francisquito Bay, about 35 miles north of the town Loreto, Baja California, Mexico, to Punta Peñasco, Sonora, Mexico. Jord and Evermann (1898, p. 2341) list this species from La Paz, Baja Calif but specimens from this locality have not been seen.

Tomicodon myersi, new species

Figure 88

DIAGNOSIS: A small *Tomicodon* with 4 pairs of trifid incisors at front upper jaw and 3 pairs of these teeth at front of lower jaw. Dermal fla extending from margin of anterior nostril, is small and simple; its heig slightly greater than width of nostril and much less than distance betwe anterior and posterior nostrils. The papillae of the innermost row in di region A are noticeably elongate. Dorsal rays 7 (6-8), anal rays 6 (5-8 pectoral rays 21 (20-21), and caudal rays 8 (7-8).

DESCRIPTION: Body moderately depressed, depth 5.6 (5.3-5.9) in standa length. Caudal peduncle long, least depth 2.0 (1.9-2.2) in its lengt Anus located slightly closer to anal fin origin than to rear margin disc, or equidistant between them.

Head depressed, length 3.1 and width 3.6 (3.3-4.0) in standard lengt Snout shallow with a rounded outline 3.3 (3.2-3.6) in head; posterior no tril above or slightly behind anterior edge of eye. Teeth at front upper jaw trifid incisors, followed on each side by 1 or 2 well-develop canines. Teeth at front of lower jaw also trifid incisors, followed each side by a single well-developed canine.

Greatest diameter of eye 0.8 (0.7-0.8) in bony interorbital space a 4.4 (4.2-4.7) in head. Subopercular spine poorly developed and hidden heavy skin of opercle region. Upper attachment of axial dermal flap opp site 5th (4-7) pectoral ray.

Dorsal-caudal distance forward extends as far as tip of pectoral fin just behind this point; postdorsal-caudal distance 0.6 (0.5-0.6) in dors length. Length of disc 3.7 (3.6-3.8) in standard length; 5 (4-5) ro of flattened papillae across width of disc region A, those of the innermo row noticeably elongate; 6 (5-7) rows across width of disc region B.

COLORATION: In material preserved in alcohol for a short time (thr months), the dorsum has a light orange ground color, extending down sid just behind pectoral fin. Posteriorly three vertical, light orange ba can be seen on sides. In addition, a series of fine, black vermiculatio appear on the back and sides. The dorsal fin has a heavy, longitudina black stripe, and the caudal fin has a concentration of melanophores alo the dorsal and ventral edges. A few melanophores occur on the dorsal ed of the pectoral, while the rest of this fin and the anal fin are non-pi mented. The ventral side of the body is very pale with no apparent col pattern.

RELATIONSHIP: This species is most closely related to *T. vermiculatus* an endemic form found on Cocos Island. There are differences in head si and body depth, but otherwise they are very close.

HOLOTYPE: Stanford University number 47688; 20.4 mm. in standard lengt This specimen was taken on the 1952 Sefton-Stanford Expedition to the Gu of California at the rocky south-west end of San Lucas Bay, Baja Cali ornia, Mexico, on May 20, 1952. The individual collectors were J. Böhlk D. Cohen, and J. Lindbergh.

PARATYPES: SU 47689; five specimens, from 17.2 mm. to 20.7 mm. in sta dard length, taken with the holotype. SU 47690; three, from 19.6 mm.

23 mm. in standard length, taken by the Eastern Pacific *Zaca* (1937-38) Expedition of the New York Zoological Society from tidepools at Chamela Bay, Jalisco, Mexico, on November 18, 1937.

DERIVATION OF NAME: This species is named for Dr. George S. Myers of Stanford University, in recognition of his many contributions to the knowledge of the fish fauna of the Eastern Pacific, and also in gratitude for his assistance with this monograph.

Tomicodon vermiculatus, new species

Figure 89

DIAGNOSIS: A small *Tomicodon* with 4 pairs of trifid incisors in upper jaw and 3 pairs of these teeth in lower jaw. Anus closer to origin of anal fin than to rear margin of disc. Dermal flap extending from the margin of the anterior nostril is medium in size, the height greater than diameter of nostril, but less than distance between anterior and posterior nostrils. Seven black spots present above base of pectoral fin. Dorsal rays 7, anal rays 7, pectoral rays 20, and caudal rays 8.

DESCRIPTION: Body well depressed, depth 9.1 in standard length. Caudal peduncle medium, least depth 2.0 in its length. Head depressed and narrow, length 3.4 and width 4.5 in standard length. Snout moderately steep with a rounded outline, 3.4 in head; posterior nostril located directly above anterior edge of eye. Incisors in both upper and lower jaws followed on each side by 2 well-developed canines.

Greatest diameter of eye 0.8 in bony interorbital space and 4.1 in head. Subopercular spine relatively well developed, but hidden by heavy skin of opercle region. Upper attachment of axial dermal flap opposite 4th pectoral ray. Dorsal-caudal distance forward does not extend as far as tip of pectoral fin; postdorsal-caudal distance 0.5 in dorsal length. Length of disc 3.9 in standard length; 4 rows of flattened papillae across width of disc region A; 6 rows across width of disc region B.

COLORATION: In alcohol, the ground color of the dorsal and lateral sides very pale. Covering this area is a fine network of brown vermiculations somewhat separated by six transverse lighter regions. In general, the amount of dorsal pigmentation is small compared with that of the mainland species. There are no prominent black spots above the bases of the pectoral fin nor along the sides. The dorsal fin is light gray with a concentration of melanophores along each ray. The pectoral fin is pigmented only at the base. The anal fin and the ventral surface of the body are very pale with no apparent color pattern.

RELATIONSHIP: It was interesting to find that this species is most closely related to *T. myersi*, a form now apparently confined to the coast of Northern Mexico. *T. vermiculatus* may be distinguished from it by its more flattened body and shorter and more slender head.

HOLOTYPE: Stanford University number 47691; 23.4 mm. in standard length, from Chatham Bay, Cocos Island. It was collected by L. Kinonobu, on December 25, 1952.

DERIVATION OF NAME: The name is from the Latin *vermiculatus*, wormy, in reference to the color pattern on the dorsum.

Tomicodon zebra (Jordan and Gilbert)

Diesox zebra Jordan and Gilbert, 1882a, p. 359 (Mazatlán).
Bathosa zebra Jordan and Evermann, 1896, p. 403 (Mazatlán); 1898, p. 2341 (Mazatlán).—Jordan, Evermann, and Clark, 1930, p. 491 (Mazatlán).

DIAGNOSIS: A medium-sized *Tomicodon* with 4 or 5 pairs of trifid incisors

in upper jaw and 3 pairs in lower jaw. Anus much closer to rear margin o disc than to anal fin origin. Dermal flap extending from margin of ante rior nostril medium in size, height considerably greater than diameter o nostril and about equal to distance between anterior and posterior nostrils Anterior edge of eye extends in front of posterior nostril. Dorsal rays (7-8), anal rays 7 (6-7), pectoral rays 20 (19-21), and caudal rays 8.

DESCRIPTION: Body moderately depressed, depth 6.7 (6.2-7.7) in standar length. Caudal peduncle long, least depth 1.8 (1.5-2.3) in its length Maximum known size 46.4 mm. standard length.

Head depressed, length 3.2 (3.2-3.3) and width 3.6 (3.3-4.0) in standar length. Snout fairly steep, with a rounded outline, 3.6 (3.4-3.9) in heal Teeth at front of upper jaw trifid incisors, followed on each side by 1 o 2 well-developed canines. Teeth at front of lower jaw also trifid incisors followed on each side by 2 (1-3), usually 2 or 3, well-developed canines.

Greatest diameter of eye 0.8 (0.7-1.0) in bony interorbital space an 4.2 (3.7-4.6) in head. Subopercular spine poorly developed and hidden o heavy skin of opercle region. Upper attachment of axial dermal flap oppo site 5th (4-6) pectoral ray.

Dorsal-caudal distance forward does not extend as far as tip of pectora fin; postdorsal-caudal distance 0.6 (0.6-0.7) in dorsal length. Length o disc 3.2 (3.2-3.3) in standard length; 6 (5-7) rows of flattened papilla across width of disc region A; 7 (6-8) rows across width of disc region B

COLORATION: In alcohol, the ground color of the dorsal and lateral side is very pale and, in comparatively fresh material, varying amounts of re usually can be seen on the back. The back is also figured with dark gra to black vermiculations, some of these usually concentrated into hour-glas shaped figures at right angles to the length of the body. In addition, tw prominent black spots usually can be seen on the back, one on each side o the midbody line, a short distance above the base of the pectoral fin. Th sides are blackish or supplied with small spots and/or vermiculations. Th fins are usually gray, and a light, vertical bar may be found on the caude fin near the base. The ventral surface of the body is very pale with n apparent color pattern.

RELATIONSHIP: This species is fairly close to both *T. boehlkei* and *T. petersi*, but can be separated by such characters as: location of posteric nostril in relation to anterior edge of eye; position of anus, size of der mal flap on anterior nostril, and numbers of teeth.

MATERIAL EXAMINED: SU 17858; one specimen from Tangola-Tangola Bay Oaxaca, Mexico. SU 18125; one, from Puerto Guatulco, Oaxaca, Mexico. S 17859; two, from Chamela Bay, Jalisco, Mexico. USNM 29250; two (syntype of *Gobiesox zebra*), from Mazatlán, Sinaloa, Mexico. SU 2947; three, fro Mazatlán. SU 17857, 17861 and 19388; 25, from San Lucas Bay, Baja Calif. Mexico.

RANGE: From Tangola-Tangola Bay, Oaxaca, Mexico, to Guaymas, Sonora Mexico.

Tomicodon petersi (Garman)

Sicyases petersii Garman, 1875, p. 203 (San José, San Miguel, and Siboga all Pearl Islands, Panama Bay).

Sicyases pyrrhocinclus Cope, 1877, p. 27 (Peru).

Arbaciosa zebra (*non* Jordan and Gilbert) Kendall and Radcliffe, 1912. p 160 (Taboguilla Island).—Meek and Hildebrand (*non* Jordan and Gil bert), 1928, p. 927 (Taboguilla Island, Panama).

Arbaciosa pyrrhocinclus Abbott, 1899, p. 363 (Peru).—Fowler, 1945a. p. 267 fig. 91 (Peru).—Hildebrand, 1946, p. 490, fig. 93 (coast of Peru).

Arbaciosa petersii Abbott, 1899, p. 363 (Peru).—Briggs, 1951, p. 101 (u

part; Lobos de Tierra Island, Peru, to Oaxaca only; Punta Peñasco specimens excluded).

Gobiesox rhodospila Schultz (*non* Günther), 1944, p. 59 (in part; Gulf of California to Ecuador; Gulf of California material excluded).

Tomicodon cessator Fowler, 1944b, p. 236, fig. 258 (Playa Muerto, Panama).

DIAGNOSIS: A medium-sized *Tomicodon* with 4 to 7 pairs of trifid incisors in upper jaw and 3 or 4 pairs in the lower jaw. Anus usually somewhat nearer to anal fin origin than to rear margin of disc. Dermal flap extending from margin of anterior nostril medium in size, the height considerably greater than diameter of nostril but less than distance between anterior and posterior nostrils. Dorsal rays 7 (7-8), anal rays 7 (6-7), pectoral rays 20 (19-21), and caudal rays 9 (8-10).

DESCRIPTION: Body moderately depressed, depth 7.4 (6.1-10.0) in standard length. Caudal peduncle medium, least depth 1.7 (1.4-2.1) in its length. Maximum known size 45.6 mm. standard length.

Head depressed, length 3.2 (3.1-3.3) and width 4.0 (3.6-4.3) in standard length. Snout moderately shallow with a rounded outline, 3.4 (3.2-3.8) in head; posterior nostril in front of anterior edge of eye. Teeth at front of upper jaw trifid incisors; the lowest number (4 pairs) is found only in the smallest specimens: those less than 26.2 mm. in standard length. These followed on each side by 1 or 2, usually 2, well-developed canines. Teeth at front of lower jaw also trifid incisors followed on each side by 1 or 2, usually 2, well-developed canines.

Greatest diameter of eye 1.0 (0.8-1.2) in bony interorbital space and 4.3 (4.3-5.2) in head. Subopercular spine poorly developed and hidden by wavy skin of opercle region. Upper attachment of axial dermal flap opposite 6th (5-7) pectoral ray.

Dorsal-caudal distance forward does not extend as far as tip of pectoral fin; postdorsal-caudal distance 0.7 (0.5-0.8) in dorsal length. Length of disc 3.8 (3.4-4.0), usually 3.6-4.0, in standard length; 5 (4-6) rows of flattened papillae across width of disc region A; 7 (6-8) rows across width of disc region B.

COLORATION: In alcohol, the ground color of the dorsal and lateral sides is very pale. The back is figured with dark gray to black vermiculations, some of these usually concentrated into hour-glass shaped figures at right angles to the length of the body. In addition, 2 prominent black spots usually can be seen, one on each side of the midbody line a short distance above the base of the pectoral fin. The sides are usually supplied with elongate, blackish spots. The fins are light gray with a concentration of melanophores along each ray. The ventral surface of the body is very pale with no apparent color pattern.

RELATIONSHIP: This species is most closely related to *T. boehlkei*, even though they are apparently well-separated geographically. The two forms may be differentiated by the numbers of teeth, size of dermal flap on anterior nostril, length of disc, and width of head. *T. petersi* is further characterized by changes which occur during growth, especially in regard to the numbers of incisors in upper jaw. Four pairs of these teeth are found in the smallest specimens (those under 26.2 mm.), 5 pairs in the medium-sized individuals, and 6 or 7 pairs in the largest specimens. In contrast, the number of incisors in the upper jaw of *T. boehlkei* remains constant at 4 pairs during ontogeny. A growth-correlated change is also apparent in the position of the anus in *T. petersi*. In the smaller specimens this structure is usually near the mid-point between the rear margin of the disc and the anal origin; in the large individuals there is a tendency for it to become displaced posteriorly.

MATERIAL EXAMINED: CAS 3637 and 5348-5354; eight specimens, from Santa María Island, Galápagos. CAS 3059 and 3060; 10, from James Bay, San Sal-

vador Island, Galápagos. CAS 4336-4344; nine, from Española Island, Gal pagos. SU 17839; three, from Saboga Island, Panama Bay, Panama. US 120435; three (syntypes of *Sicyases petersii*), from the Pearl Islands Panama. SU 17855; and 17856; 11, from Bahia Honda, Panama. SU 17853 a 17854; 10, from Uvita Bay, Costa Rica. SU 17852; 28, from Piedra Blan Bay, Costa Rica. CAS 4068-4070; three, from Braxilito Bay, Costa Ric SU 17850 and 17851; nine, from Puerto Culebra, Costa Rica. SU 17844 17849; 28, from Puerto Parker, Costa Rica. SU 17843; three, from San Ju del Sur, Nicaragua. SU 17842; one, from Corinto, Nicaragua. SU 17840 a 17841; seven, from the Gulf of Fonseca, Nicaragua. SU 18124; one, fr Puerto Guatulco, Oaxaca, Mexico.

RANGE: From Lobos de Tierra Islands, Peru, and the Galápagos Islands Ecuador, to Puerto Guatulco, Oaxaca, Mexico.

Tomicodon boehlkei, new species

Figure 90

DIAGNOSIS: A fairly large *Tomicodon* with 4 pairs of trifid incisors upper jaw and 3 pairs in lower jaw. Anus usually a little closer to an fin origin than to rear margin of disc. Dermal flap extending from marg of anterior nostril small, the height usually a little greater than diamet of nostril. Usually a pattern of elongate, blackish spots on sides posterior half of body. Dorsal rays 7 (6-8), anal rays 7 (6-7), pectora rays 20 (19-22), and caudal rays 8 (8-9).

DESCRIPTION: Body moderately depressed, depth 7.8 (6.8-8.9) in standa length. Caudal peduncle long, least depth 1.9 (1.5-2.1) in its length Maximum known size 61.1 mm. in standard length.

Head depressed, length 3.1 (2.7-3.4) and width 3.6 (3.4-3.9) in standa length. Snout moderately shallow with a rounded outline, 3.4 (3.2-3.7) head; posterior nostril in front of anterior edge of eye. Teeth at fro of upper jaw trifid incisors, followed on each side by 1 or 2, usually well-developed canine. Teeth at front of lower jaw also trifid incisor followed on each side by 1 or 2, usually 1, well-developed canine.

Greatest diameter of eye 1.1 (0.8-1.3) in bony interorbital space a 5.1 (3.8-6.8) in head. Subopercular spine poorly developed and hidden heavy skin of opercle region. Upper attachment of axial dermal flap opp site 6th (5-7) pectoral ray.

Dorsal-caudal distance forward does not extend as far as tip of pector fin; postdorsal-caudal distance 0.7 (0.6-0.9) in dorsal length. Length disc 3.5 (3.3-3.7) in standard length; 6 (5-7) rows of flattened papill across width of disc region A; 7 (6-8) rows across width of disc region B

COLORATION: In alcohol, the ground color of the dorsal and lateral sid is very pale and, in comparatively fresh material, varying amounts of r usually can be seen on the back. In addition, the back is figured wit dark gray to black vermiculations, some of these at times assuming hou glass shapes at right angles to the length of the body. Also, two pro inent black spots usually can be seen on the back, one on each side of t midbody line, a short distance above the base of the pectoral fin. T fins are a dark gray with a pale, vertical bar across the middle of t caudal. The ventral side of the body is very pale with faint dark cros bars sometimes appearing between the anal and caudal fins.

RELATIONSHIP: This species is most closely related to *T. petersi*, ev though they are apparently well separated geographically. The two for may be differentiated by the number of teeth, size of dermal flap on ant rior nostril, length of disc, and width of head.

HOLOTYPE: Stanford University number 17810; 41.1 mm. in standard lengt taken on the 1952 Sefton-Stanford *Orca* Expedition to the Gulf of Californi

was collected on the northwest shore of San Francisquito Bay, about 35 es north of the town of Loreto, Baja California, Mexico, by J. Böhlke, Cohen, J. Lindbergh, F. Cliff, R. Moran, J. Savage, and J. Figg-Hoblyn, May 13, 1952. ..

PARATYPES: SU 17811; 118 specimens, from 22.1 mm. to 51.4 mm. in standard length, taken with the holotype.

MATERIAL EXAMINED: In addition to those specimens listed as types, the lowing material was studied: SU 18911; one, from San Lucas Bay, Baja ifornia, Mexico. SU 18910; 18912; 17830-17832; 100, from Ildefonso and, Baja Calif., Mexico. SU 17812; one, from Santa Inez Bay, Baja if., Mexico. SU 92; two, from Guaymas, Sonora, Mexico. SU 16387; 89-16390; 16392-16393; 262, from San Carlos Bay, Sonora, Mexico. SU 88; 16391; 39, from Ensenada San Francisco, Sonora, Mexico. SU 17819; r, from San Pedro Nolasco Island, Sonora, Mexico. SU 32225; one, from Bluff Bay, Tiburón Island, Sonora, Mexico. SU 17825; 18, from Mejia and, Baja Calif., Mexico. SU 17813; 21, from Puerto Libertad, Sonora, ico. SU 16386; two, from Punta Peñasco, Sonora, Mexico.

RANGE: From San Lucas Bay, Baja Calif., Mexico, to Punta Peñasco, ora, Mexico.

REMARKS: This species of clingfish, one of the most numerous in the Gulf California, was formerly thought to be identical with *T. petersi* of ama and adjacent areas. However, an examination of much new material shown that specific differences exist.

DERIVATION OF NAME: This form has been named after Dr. James E. Böhlke Stanford, now at the Academy of Natural Sciences of Philadelphia, in cognition of his kindness in making an extensive collection of clingshes in the Gulf of California during the 1952 Sefton-Stanford *Orca* Exition.

Tomicodon abitus, new species

Figure 91

DIAGNOSIS: A small *Tomicodon* with 4 pairs of trifid incisors in upper and 3 pairs in lower jaw. Anus about halfway between rear margin of c and anal fin origin or a little closer to the latter. Dermal flap ending from margin of anterior nostril small, the height usually a tle greater than diameter of nostril. No pattern of large spots or bars sides of body. Dorsal rays 7, anal rays 7 (6-7), pectoral rays 20, and dal rays 8.

DESCRIPTION: Body moderately depressed, depth 6.4 (6.2-6.5) in standard gth. Caudal peduncle long, least depth 2.0 (1.7-2.2) in its length.

Head depressed, length 3.1 (2.9-3.2) and width 3.6 (3.5-3.8) in standard gth. Snout moderately shallow with a rounded outline, 3.6 (3.4-3.7) in d; posterior nostril above or slightly behind anterior edge of eye. th at front of upper jaw trifid incisors, followed on each side by 1 ll canine. Teeth at front of lower jaw also trifid incisors, followed each side by 1 well-developed canine. In the larger specimens of the ies it was noted that the middle cusp in each of the central pairs of isors in the lower jaw was noticeably elongate, more so than in specis of comparable size in each of the two most closely related species *boehlkei* and *T. petersi*). However, this condition was not apparent in smaller specimens.

Greatest diameter of eye 0.8 in bony interorbital space and 3.8 (3.7-) in head. Subopercular spine poorly developed and hidden by heavy skin opercle region. Upper attachment of axial dermal flap opposite 5th (5-) pectoral ray.

Dorsal-caudal distance forward may extend as far as tip of pectoral fin

but usually is behind this point; postdorsal-caudal distance 0.6 in do length. Length of disc 3.3 (3.2-3.5) in standard length; 5 (4-6) row flattened papillae across width of disc region A; 5 (5-6) rows across w of disc region B.

COLORATION: In alcohol, the ground color is very pale. Dorsally, and body are covered with very small, dark-brown spots. These tend t concentrated into four large, ill-defined areas along the center of back. Also, two prominent black spots can usually be seen on the back, on each side of the midbody line, a short distance above the base of pectoral fin. There is a pale, vertical bar across the caudal base bu apparent pattern on the other fins. The ventral side of the body beh the anus is covered with small, dark-brown spots, but the anterior ve is mainly colorless and translucent. The dorsal side of the poste extension of the disc is well covered with melanophores.

RELATIONSHIP: It was interesting to find that this island species most closely related to *T. boehlkei*, a form apparently confined to the of California. It is most easily separated from that mainland specie the use of such characters as color pattern, position of posterior nos in relation to anterior edge of eye, and number of rows of flattened pillae in disc region B.

HOLOTYPE: California Academy of Sciences number 2138; 14.2 mm. in st dard length, from Socorro Island, Revilla Gigedo Archipelago, Mexico. name of the collector and date of capture are unknown.

PARATYPES: SU 17809; two specimens, 12.8 mm. and 16.9 mm. in stand length, apparently taken with the holotype. CAS 1567; 1569; 1655; 18 2132; 2139; 2140; seven specimens, from 9.3 mm. to 17.8 mm. in stand length, also apparently taken with the holotype.

DERIVATION OF NAME: The name is from the Latin *absitus*, distant, ferring to the isolated range of the species herein described.

Tomicodon fasciatus fasciatus (Peters)

Sicyases fasciatus Peters, 1860, p. 412 (Puerto Cabello).—Günther, 18 p. 497 (Puerto Cabello).—Jordan, Evermann, and Clark, 1930, p. (Puerto Cabello, Venezuela).
Gobiesox rupestris Poey, 1860, p. 238, pl. 18 (Cuba).
Sicyases rupestris Poey, 1868, p. 391 (Cuba).
Gobiesox fasciatus Jordan and Evermann, 1896, p. 492 (Puerto Cabell 1898, p. 2338 (Puerto Cabello).
Arbaciosa rupestris Jordan and Evermann, 1896, p. 492 (Cuba); 1898, p. 2 (Cuba).—Beebe and Tee-Van, 1928, p. 262, fig. (Port-au-Prin Haiti).—Jordan, Evermann, and Clark, 1930, p. 491 (Cuba).—Pa 1930, p. 136 (Green Cay, Bahamas).
Arbaciosa minuta Meek and Hildebrand, 1928, p. 928, pl. 92 (Colón, Panam
Arbaciosa fasciata Schultz, 1944, p. 60 (West Indies: Guatemala to Brazi

DIAGNOSIS: A medium *Tomicodon* with 4 or 5 pairs of trifid incisors upper jaw and 3 or 4 pairs in lower jaw. Anus usually a little closer anal fin origin than to rear margin of disc. Dermal flap extending f margin of anterior nostril is minute or absent. If present it is simp height less than diameter of nostril. No prominent black spot present each side of midbody line a short distance above base of pectoral f Dorsal rays 8 (7-9), anal rays 7 (6-9), pectoral rays 21 (20-22), and c dal rays 8.

DESCRIPTION: Body moderately depressed, depth 7.5 (6.6-8.4) in stand length. Caudal peduncle medium, least depth 1.7 (1.5-1.8) in its leng Maximum known size 34.4 mm. standard length.

ead depressed, length 3.2 (2.8-3.6) and width 4.3 (3.8-5.5) in standard
th. Snout moderately shallow with a rounded outline, 3.9 (3.4-4.3) in
; posterior nostril usually just in front of anterior edge of eye, but
ay be found above or, rarely, just behind this point. Teeth at front
pper jaw trifid incisors, followed on each side by 1 or 2, usually 1,
-developed canine. Teeth at front of lower jaw also trifid incisors,
owed on each side by 1 or 2, usually 1, well-developed canine.
Greatest diameter of eye 0.8 (0.7-0.9) in bony interorbital space and
(3.7-4.4) in head. Subopercular spine poorly developed and hidden by
y skin of opercle region. Upper attachment of axial dermal flap oppo-
5th (5-6) pectoral ray.
Dorsal-caudal distance forward may extend as far as tip of pectoral fin,
usually to a point behind this appendage; postdorsal-caudal distance
(0.7-0.8) in dorsal length. Length of disc 4.1 (4.0-4.5) in standard
gth. Five (4-6) rows of flattened papillae across width of disc region
(5-7) rows across width of disc region B.
COLORATION: In alcohol, the ground color of the dorsal and lateral sides
light brown. On the back, darker brown spots can be seen, which have a
dency to become concentrated into hour-glass shaped figures lying at
t angles to the length of the body. The sides are supplied with heavy,
kish bars which extend partially on to the ventral surface. The dorsal
is dark brown and the caudal fin a medium brown with a faint, vertical,
bar across the center. The anal and pectoral fins are light brown.
anterior part of the ventral side is colorless and translucent, but the
erior portion is lightly pigmented toward the sides.
RELATIONSHIP: Excluding the subspecies to the south, this form is most
sely related to *T. petersi*, a common Eastern Pacific species. The two
be separated by differences in size of dermal flap on anterior nostril,
r pattern, eye size, and (frequently) the number of caudal rays.
MATERIAL EXAMINED: SU 3249; one specimen from Curaçao Island, Nether-
ls West Indies. KZM 21.9.1916.577-580; four, from the Virgin Islands.
Z 141913; six, from Puerto Barrios, Guatemala. USNM 37414; one, from
. UM 875; six, from Andros Island, Bahamas. UM 824 and 589; two, from
ni, Bahamas. UM 868; four, from Cotton Cay, Anguila Islands, Cay Sal
, Bahamas.
RANGE: From Puerto Cabello, Venezuela, to Puerto Barrios, Guatemala, and
West Indies.

Tomicodon fasciatus australis, new subspecies

Figure 92

DIAGNOSIS: A medium-sized *Tomicodon* with 4 or 5 pairs of trifid incisors
pper jaw and 3 pairs in lower jaw. Anus closer to anal fin origin than
rear margin of disc. Dermal flap extending from margin of anterior
ril very small and simple, its height about equal to diameter of nos-
. No prominent black spot present on each side of midbody a short dis-
ce above base of pectoral fin. Dorsal rays 8 (7-9), anal rays 7 (7-9),
udal rays 20 (18-21), and caudal rays 8.
DESCRIPTION: Body moderately depressed, depth 6.8 (6.2-8.2) in standard
gth. Caudal peduncle medium, least depth 1.7 (1.4-2.0) in its length.
ead depressed, length 3.2 (3.0-3.4) and width 4.3 (4.0-4.4) in standard
gth. Snout moderately shallow with a rounded outline, 3.8 (3.4-4.0) in
; posterior nostril just in front of anterior edge of eye. Teeth at
nt of upper jaw trifid incisors, followed on each side by 2 well-devel-
canines. Teeth at front of lower jaw also trifid incisors, followed
each side by 1 to 3, usually 2, well-developed canines.
Greatest diameter of eye 0.8 (0.8-0.9) in bony interorbital space and

4.6 (3.8-4.9) in head. Subopercular spine poorly developed and hidden heavy skin of opercle region. Upper attachment of axial dermal flap op site 5th (4-6) pectoral ray.

Dorsal-caudal distance measured forward may extend as far as tip of toral fin, but usually to a point behind this appendage; postdorsal-ca distance 0.8 (0.7-0.9) in dorsal length. Length of disc 3.8 (3.5-3.9) standard length; 4 rows of flattened papillae across width of disc re A; 5 (5-6) rows across width of disc region B.

COLORATION: In alcohol, the ground color of the dorsal and lateral s is very pale. On the back a series of large, dark-brown spots can be s which have a tendency to become concentrated into hour-glass shaped fig lying at right angles to the width of the body. The sides are suppl with dark-brown, vertical bars which extend partially on the ventral s face. The anterior portion of the dorsal fin is dark brown while the po erior portion is much lighter. Two dark-brown, vertical bars can be s on the caudal fin. The anal fin is very pale with a little brown pig at the base. The pectoral is dark brown at the base but otherwise n pigmented and translucent. The anterior part of the ventral side is co less except for some brown color on the chin. The posterior portion provided with brown bars toward the sides.

RELATIONSHIP: This subspecies is, of course, closely related to other Western Atlantic representative of the genus *Tomicodon*, *T. fasci fasciatus*. It is most readily separated by the larger disc and larger mal flap on margin of anterior nostril.

HOLOTYPE: U. S. National Museum number 88042; 25.8 mm. in standard len taken by Dr. Waldo L. Schmitt at São Francisco do Sul, Santa Catari Brazil, on October, 29, 1925.

PARATYPES: USNM 88042, 87799-87802; 15 specimens, from 21.7 to 27.8 in standard length, taken with the holotype. SU 17835; two, 25.2 mm. 26.4 mm. in standard length, also taken with the holotype. USNM 878 one, 23.9 mm. in standard length, taken by W. L. Schmitt at Canto do R Niteroi, Rio de Janiero, Brazil, on August 22, 1925.

DERIVATION OF NAME: The name is from the Latin *australis*, southern.

Tomicodon chilensis Brisout de Barneville

Tomicodon chilensis Brisout de Barneville, 1846a, p. 144 (Valparai Chile).

Gobiesox zebra (*non* Jordan and Gilbert) Gilbert, 1890b, p. 452 (Dun Island Galápagos).—Regan (*non* Jordan and Gilbert), 1913a, p. (Lobos de Tierra Island, Peru).

Arbaciosa truncata Heller and Snodgrass, 1903, p. 216, pl. 14 (Tagus Co Albemarle Island, Galápagos).—Kendall and Radcliffe, 1912, p. (Chatham Island, Galápagos).—Herre, 1936, p. 391 (South Seym Island and Eden Island, Galápagos).—Briggs, 1951, p. 103 (Para Bay to Lobos de Afuera Islands, Peru, and the Galápagos Islands

Arbaciosa hieroglyphica Evermann and Radcliffe, 1917, p. 155, pl. 14, f 2 (Paracas Bay; Lobos de Afuera Island).—Fowler, 1945a, p. (Paracas Bay; Lobos de Afuera Island).

Arbaciosa pyrrhocincla pyrrhocincla (*non* Cope) Schultz, 1944, p. 59 (Pe

Arbaciosa pyrrhocincla truncata Schultz, 1944, p. 59 (Galápagos Islands)

Arbaciosa petersii (*non* Garman) Mann and Capurro, 1951, p. 4 (Ari Tarapacá, Chile).

DIAGNOSIS: A medium-sized *Tomicodon* with 4 pairs of incisors at front each jaw. The middle pair usually have smooth edges while the others trifid. Anus much closer to anal fin origin than to rear margin of di

al flap extending from margin of anterior nostril quite variable in , height usually a little greater than diameter of nostril but less distance between anterior and posterior nostrils. Dorsal rays 8 (7- anal rays 7 (6-9), pectoral rays 20 (19-22), and caudal rays 9 (8-10).

ESCRIPTION: Body moderately depressed, depth 6.4 (5.6-7.3) in standard th. Caudal peduncle medium, least depth 1.5 (1.4-1.7) in its length. mum known size 46.5 mm. standard length.

ead depressed, length 3.1 (2.9-3.2) and width 3.6 (3.2-4.2) in standard th. Snout shallow with a rounded outline, 3.3 (3.1-3.4) in head; post- r nostril in front of anterior edge of eye. Teeth at front of upper incisors, followed on each side by a single, well-developed canine. h at front of lower jaw also incisors, followed on each side by 1 or sually 1, well-developed canine.

reatest diameter of eye 1.0 (0.8-1.4) in bony interorbital space and (4.7-6.1) in head. Subopercular spine poorly developed and hidden by y skin of opercle region. Upper attachment of axial dermal flap oppo- 5th (4-7) pectoral ray.

orsal-caudal distance forward does not extend as far as tip of pec- l fin; postdorsal-caudal distance 0.8 (0.7-1.2) in dorsal length. th of disc 3.6 (3.5-3.8) in standard length; 6 (6-7) rows of flattened llae across width of disc region A; 7 (5-8) rows across width of disc on B.

OLORATION: In alcohol, the ground color is very pale. The dorsal and eral sides are supplied with numerous small, dark-gray or black spots vermiculations. In addition, two prominent black spots usually can be , one on each side of the midbody line a short distance above the base he pectoral fin. The median fins are gray with very light tips while pectorals are an even light gray. The ventral surface of the body is pale with no apparent pigment pattern.

ELATIONSHIP: Although this species is very distinct, it is probably er to *T. eos* than to any of the other known forms. It can be separated ily from this species through the several differences listed in the

ATERIAL EXAMINED: UT (not numbered); three specimens from Arica, Tara- , Chile. MCZ 12920; 32, from Paracas Bay, Ica, Peru. KZM 18.9.1841; , from Callao, Peru. SU 16457; 37547; 51, from Lobos de Afuera Is- ls, Peru. NMW (not numbered); two, from Paita, Peru. SU 6341; one, e holotype of *Arbaciosa truncata*), from Isabela (Albermarle) Island, pagos. SU 7058; 21193; 24 (paratypes of *A. truncata*), from Isabela nd, Galápagos. SU 24376; 24397; 37548-37552; 68, from various locali- s in the Galápagos Islands.

ANGE: Valparaiso, Chile, to the Galápagos Islands, Ecuador.

Tomicodon eos eos (Jordan and Gilbert)

esox eos Jordan and Gilbert, 1882a, p. 360 (Mazatlán).
ciosa eos Jordan, 1896, p. 230, pl. 37 (Mazatlán).—Jordan and Evermann, 1896, p. 491 (Pacific coast of Mexico); 1898, p. 2343 (Mazatlán). Osburn and Nichols, 1916, p. 178 (in part; southern Gulf specimens only).—Ulrey, 1929, p. 11 (Gulf of California).—Jordan, Evermann, and Clark, 1930, p. 491 (Pacific coast of Mexico).—Schultz, 1944 p. 58 (Mazatlán, Mexico).—Briggs, 1951, p. 103 (in part; Mazatlán specimens only).

DIAGNOSIS: A small, robust *Tomicodon* with 3 or 4 pairs of trifid in- ors at front of each jaw. Anus a little closer to anal fin origin than rear margin of disc. Dermal flap extending from the margin of the ante-

rior nostril comparatively large, simple, and broad at distal end; he about equal to distance between anterior and posterior nostrils. C when alive is said to be a bright, rosy red. Dorsal rays 8 (8-9), rays 8 (7-8), pectoral rays 22 (22-23), and caudal rays 9 (8-9).

DESCRIPTION: Body moderately depressed, depth 5.2 (4.9-5.6) in stan length. Caudal peduncle medium, least depth 1.3 (1.2-1.4) in its len Maximum known size 28.8 mm. standard length.

Head depressed, length 2.6 (2.6-2.7) and width 3.3 (3.2-3.6) in stan length. Snout shallow with a rounded outline, 3.6 (3.5-3.7) in head; p erior nostril above or just behind anterior edge of eye. An equal nu of strongly trifid incisors at front of each jaw. In upper jaw these followed on each side by 1 or 2 small canines. In lower jaw 2 or 3 s canines present, well separated from incisors and from each other. Can in both jaws poorly developed and considerably smaller than incisors.

Greatest diameter of eye 0.8 (0.7-0.9) in bony interorbital space 4.6 (4.3-5.0) in head. Subopercular spine poorly developed and hidde heavy skin of opercle region. Upper attachment of axial dermal flap o site 7th (6-9) pectoral ray.

Dorsal-caudal distance forward extends to about middle one-thir pectoral fin; postdorsal-caudal distance 0.8 (0.7-0.9) in dorsal len Length of disc 3.3 (3.2-3.5) in standard length; 4 (3-5) rows of flatt papillae across width of disc region A; 5 (4-5) rows across width of region B.

COLORATION: In alcohol, the dorsal and lateral sides are a pale, tr lucent yellow, sometimes with a few light-brown lines below the eyes across the back. The median fins are very pale and translucent and pectorals are the same except that a light-brown, pigmented area ma seen at the bases. The ventral surface of the body is very pale wit apparent pigment pattern.

RELATIONSHIP: This seems to be the most specialized member of the ge It differs from the other known species in possessing incisors that sh stronger trifid condition, very small canines, more pectoral rays, a la dermal flap on anterior nostril, and a deeper body. Aside from its s species to the south, it is closer to *T. chilensis* than to any of others, although the relationship is obviously quite distant.

MATERIAL EXAMINED: SU 17834; three specimens from Passavera Isl Chamela Bay, Jalisco, Mexico. SU 18120; two, from Tres Marietas Isla Mexico. USNM 30889; one (a paratype of *Gobiesox eos*), from Mazatl Sinaloa, Mexico. SU 2946; one, from Mazatlán.

RANGE: From Chamela Bay, Jalisco, Mexico, to Guaymas, Sonora, Mexico the Gulf of California.

REMARKS: The pharynx of one of the Chamela Bay specimens was packed tube feet from some large echinoderm. It may be that this species is tially or wholly symbiotic. Jordan and Evermann (1898, p. 2343) have n that it is found in company with sea urchins, especially *Arbacia stella*

Tomicodon eos rhadinus, new subspecies

Figure 93

DIAGNOSIS: A small *Tomicodon* with 3 pairs of trifid incisors at fron each jaw. Anus a little closer to anal fin origin than to rear margi disc. Dermal flap, extending from margin of anterior nostril comparati large, simple, and broad at distal end; height equal to or greater t distance between anterior and posterior nostrils. Caudal peduncle fa long, least depth 1.6 (1.5-1.7) in its length. Dorsal rays 9 (8-9), rays 8 (8-9), pectoral rays 21, and caudal rays 8 or 9.

SCRIPTION: Body moderately depressed, depth 5.7 (5.3-6.1) in standard h. Head depressed, length 2.7 and width 3.4 (3.3-3.6) in standard h. Snout shallow, with a rounded outline, 3.7 (3.6-3.8) in head; rior nostril above or just behind anterior edge of eye. Strongly d incisors at front of each jaw. In upper jaw these teeth followed on side by 1 or 2 very small canines. In lower jaw incisors followed by ll canines. Canines in both jaws poorly developed and considerably er than incisors.

eatest diameter of eye 0.7 in bony interorbital space and 4.5 (4.1- in the head. Subopercular spine poorly developed and hidden by heavy of opercle region. Upper attachment of axial dermal flap opposite 7th ral ray.

rsal-caudal distance forward extends to about middle one-third of pec- fin; postdorsal-caudal distance 0.8 (0.8-0.9) in dorsal length. h of disc 3.4 (3.4-3.5) in standard length; 4 (4-5) rows of flattened lae across width of disc region A; 4 across width of disc region B.

OLORATION: In alcohol, the dorsal and lateral sides are a pale, trans- it yellow, sometimes with a few light-brown lines below the eyes and ss the back. The median fins are very pale and translucent and the rals are the same except that a light-brown, pigmented area sometimes e seen at the bases. The ventral surface of the body is very pale, no apparent pigment pattern. In life, this subspecies is probably a it red color.

ELATIONSHIP: This form is quite close to the subspecies to the north it is expected that eventually intergrades will be found somewhere in zone between the Gulf of Tehuantepec and Chamela Bay. It may be sep- ed readily from *T. eos eos* by the characters listed in the key.

OLOTYPE: Stanford University number 18121; 21.1 mm. in standard length. specimen was taken by the Eastern Pacific *Zaca* (1937-38) Expedition of New York Zoological Society, at Tangola-Tangola Bay, Oaxaca, Mexico, ecember 12, 1937.

ARATYPES: SU 18122; one specimen, 17.9 mm. in standard length, taken the holotype. SU 18123; one, 20.1 mm. in standard length, also taken ne Eastern Pacific *Zaca* Expedition, at Puerto Guatulco, Oaxaca, Mexico, ecember 3, 1937.

ERIVATION OF NAME: From the Greek, *rhadinos*, slender, or tapering.

Genus ECKLONIAICHTHYS Smith

Figures 32, 60; Map 13

oniaichthys Smith, 1943, p. 67 (type species *Eckloniaichthys scylli- orhiniceps* Smith by original designation).

ody only a little depressed anteriorly, slender, with snout projecting ntly from dorsal outline of head; head well depressed. Three shallow, hy lobes appear beneath tip of lower jaw, but none are found elsewhere ead. Nostrils on each side well separated, distinctly tubular. Upper as delineated by premaxillary groove, comparatively narrow, and no r at front of snout than at sides.

single row of teeth in each jaw. Those at front of lower jaw well- loped incisors with rounded tips, followed on each side by weak ca- s. Teeth in upper jaw small, recurved, and conical. Four very shallow, t rakers on each gill arch. Edges of gill membranes attached laterally ort distance in front of upper pectoral base. A small, shallow, fleshy on lowest portion of pectoral base. This structure is without a free,

vertical posterior margin.

Median fins quite short; first 2 dorsal and anal rays large and eas counted, instead of being much reduced as is usually the case in all genera.

Disc small, and shows a characteristic arrangement of the shall flattened papillae on its ventral surface (fig. 32). Bony support for t structure also characteristic (fig. 60), posterior portion of pelvic gir being modified to articulate with distal postcleithral bones.

Extent of external sexual dimorphism unknown in this rare genus, si but one specimen was available for examination. Vertebrae 38.

This genus is monotypic, with the single species confined to a restr ted area of the South African coast.

Eckloniaichthys scylliorhiniceps Smith

Eckloniaichthys scylliorhiniceps Smith, 1943, p. 67, fig. 1 (10 miles w of East London, South Africa); 1949, p. 384, pl. 87, fig. 1087, (tween Port Alfred and East London).

DIAGNOSIS: A small, slender fish with but a single row of teeth in e jaw. The small disc has a characteristic arrangement of the papillae its ventral surface (fig. 32). Dorsal rays 5, anal rays 6, pectoral r 18, and caudal rays 10.

DESCRIPTION: Body only a little depressed, depth 8.0 in standard leng Caudal peduncle comparatively narrow, least depth 2.8 in its length. A located well in front of dorsal origin and about halfway between the r margin of disc and origin of anal fin. Maximum known size 27.0 mm. in st dard length.

Head well depressed, length 3.5 and width 5.9 in standard length. Sn rounded in dorsal outline, 3.8 in head. Posterior nostril behind anter edge of eye; anterior nostril with a simple, dermal flap extending from posterior margin. Three pairs of well-developed, rounded incisors at fr of lower jaw, followed on each side by 3 weak canines. Upper jaw wit pairs of small, recurved, conical teeth.

Three shallow, fleshy lobes beneath tip of lower jaw but none elsewh on head. Greatest diameter of eye 0.9 in bony interorbital space and in head. Upper attachment of gill membrane opposite the 2nd pectoral r Subopercular element with no spine. A small, shallow, fleshy pad on low portion of pectoral base; it has no free, vertical, posterior marg Upper attachment of axial dermal flap opposite 4th pectoral ray.

The dorsal-caudal distance forward extends to tip of pectoral fin; po dorsal-caudal distance 0.3 in dorsal length. Length of disc 6.7 in st dard length; disc region A with one row of flattened papillae across width; 5 rows across width of disc region B; 2 rows across disc region C

COLORATION: According to Smith (1943, p. 69), the color when alive dark green-brown with numerous red-brown streaks and a bar through the e With preservation, the color changes to an orange-red, and the streaks t bright dark red. The ventral surface of the head and disc are light the dorsal and anal fins a light russet. The pectoral is light dista and the caudal is similar to the body color with a light posterior marg All body markings are lost after several years of preservation.

RELATIONSHIP: This relict species has no known close relatives.

MATERIAL EXAMINED: SU 47899; a single specimen, from near East Lond South Africa.

NGE: From Port Alfred to East London, Cape of Good Hope, South Africa.

Genus *ACYRTOPS* Schultz

Figures 9, 33, 61; Map 10

tops Schultz, 1951, p. 244 (type species *Gobiesox (Rimcola) beryllinus* Hildebrand and Ginsburg, 1927, by original designation).

ody moderately depressed anteriorly; snout rounded in dorsal outline continuous with the head. Head depressed, length 2.7-3.1 and width 4.6 in standard length. A few shallow, fleshy lobes appear beneath r jaw but not elsewhere on head. Nostrils on each side well separated, inctly tubular. Upper lip, as delineated by premaxillary groove, is ow and not noticeably wider at front than at sides.

eeth at front of upper jaw sharp-pointed and compressed. A patch of ler, conical teeth behind these and to the sides. Teeth at front of r jaw large incisors with serrated tips. Smaller, conical teeth behind e and to the sides. Six or 7 broad, pointed or blunt rakers on second arch. Edges of gill membranes attached laterally very close to upper oral base. A very small, poorly developed, fleshy pad present on lower oral base, without a free posterior margin.

edian fins quite short; dorsal rays 5-6, anal rays 5-7, and caudal rays Pectoral rays range from 20-24. Usually first ray in dorsal and anal much reduced and not externally visible except on very small specimens thin and semitransparent fin membranes. For identification, when for dissection or clearing and staining cannot be spared, it is usually to add one to the external dorsal and anal ray counts in this genus.

isc small, length 4.6-5.4 in standard length. Arrangement of the shal- flattened papillae on ventral surface of disc is similar to that found he genus *Rimicola*, although disc is considerably more elongate in the er genus (fig. 33). Bony support for disc characteristic, with shape position of distal postcleithral bones especially distinctive (fig. 61).

n external sexual dimorphism is apparent in the size and shape of the enital papilla; that of the male is more slender and elongate (fig. 9).

nty-five vertebrae are present.

here are two species in this genus, both of them confined to the West- North Atlantic. The genus most closely related is *Rimicola* of the ern North Pacific. No individuals have been taken in fresh water.

Artificial Key to the Species of *Acyrtops*

Greatest diameter of eye 1.4 (1.3-1.5) in bony interorbital space; dermal flap extending from posterior margin of anterior nostril small, height less than distance between anterior and posterior nostrils; pectoral rays 21 (20-22).....*beryllinus* (p. 74)

Greatest diameter of eye 1.8 (1.6-1.9) in bony interorbital space; dermal flap extending from posterior margin of anterior nostril large, height equal to or greater than distance between anterior and posterior nostrils; pectoral rays 22 (21-22).....*amplicirrus* (p. 74)

Acyrtops beryllinus (Hildebrand and Ginsburg)

Gobiesox (Rimicola) beryllinus Hildebrand and Ginsburg, 1927, p. 213, f
5 (Key West, Boca Chica, Florida).
Rimicola beryllinus Jordan, Evermann, and Clark, 1930, p. 490 (Key West)
Acyrtus rubiginosus (*non* Poey) Schultz, 1944, p. 56 (Florida Keys and W
Indies).

DIAGNOSIS: An *Acyrtops* with comparatively large eyes, their greate diameter 1.4 (1.3-1.5) in bony interorbital space. Dermal flap extend from posterior margin of anterior nostril small, height being only a lit greater than diameter of nostril and less than distance between anter and posterior nostrils. Dorsal rays 5 (5-6), anal rays 6 (5-6), pecto rays 21 (20-22), and caudal rays 8.

DESCRIPTION: Body moderately depressed, depth 5.8 (5.2-6.7) in stand length. Caudal peduncle medium, least depth 1.4 (1.3-1.6) in its leng Anus much closer to anal fin origin than to rear margin of disc. Maxi known size 20 mm. standard length.

Head depressed, length 2.8 (2.7-2.9) and width 3.8 (3.3-4.6) in stand length. Snout very shallow with a rounded outline, 3.0 (2.8-3.3) in he posterior nostril behind anterior edge of eye. Teeth at front of upper sharp pointed and compressed; a fairly deep patch of smaller, conical te behind these and extending to each side. Teeth at front of lower jaw 4 5 pairs of large incisors with serrated tips, each tooth possessing fro to 6 points; fairly deep patch of smaller, conical teeth behind these extending to each side.

Gill membrane attached opposite 5th pectoral ray. Subopercular sp well developed; it protrudes upon application of a little pressure. lowest 6 (5-7) pectoral rays much reduced; upper attachment of axial der flap opposite 11th (11-12) pectoral ray.

Dorsal-caudal distance forward extends to distal half of pectoral f postdorsal-caudal distance 0.7 (0.6-0.8) in dorsal length. Length of d 5.1 (4.6-5.4) in standard length; 4 rows of flattened papillae across wi of disc region A; 6 rows across width of disc region B; 2 rows across wi of disc region C.

COLORATION: In alcohol, the specimens are very pale and colorless. dark pigment spots can be seen. In life, the color is said to be bri emerald green covered with white spots and dots.

RELATIONSHIP: This species is closely allied to *A. amplicirrus*, t southern species, known so far from the Virgin Islands. The two are eas separated by the key characters.

MATERIAL EXAMINED: USNM 82581; one, from reef flat near Cayo Hutia Li Cuba. UM 879; four, from Bear Cut, Miami, Florida. SU 17783; two, f Bear Cut, Miami, Florida.

RANGE: Cayo Hutia Light, Cuba, to Miami, Florida.

Acyrtops amplicirrus, new species

Figure 94

DIAGNOSIS: An *Acyrtops* with comparatively small eyes, their greate diameter 1.8 (1.6-1.9) in bony interorbital space. Dermal flap extend from posterior margin of anterior nostril large, height much greater th diameter of nostril and equal to or greater than distance between anter and posterior nostrils. Dorsal rays 6 (5-6), anal rays 6 (6-7), pecto rays 22 (21-24), and caudal rays 8.

DESCRIPTION: Body moderately depressed, depth 5.5 (5.1-6.1) in stand

gth. Caudal peduncle medium, least depth 1.5 (1.2-1.6) in its length. rs much closer to anal fin origin than to rear margin of disc.
Head depressed, length 2.9 (2.7-3.1) and width 3.7 (3.5-4.1) in standard gth. Snout shallow with a rounded outline 3.0 (2.8-3.2) in head; post- or nostril above or behind, usually behind, anterior edge of eye. Teeth front of upper jaw sharp pointed and compressed. A shallow patch of ller, conical teeth behind these, and extending to each side.
Gill membrane attached opposite 6th (5-6) pectoral ray. Subopercular ne well developed; it protrudes upon application of a little pressure. lowest 6 or 7 pectoral rays much reduced; upper attachment of axial nal flap opposite 12th or 13th ray.
Dorsal-caudal distance forward extends to distal half of pectoral fin; tdorsal-caudal distance 0.7 (0.6-0.8) in dorsal length. Length of disc (4.8-5.4) in standard length; 4 (3-4) rows of flattened papillae across ith of disc region A; 5 (5-6) rows across width of disc region B; 2 rows oss width of disc region C.
COLORATION: In alcohol, the specimens are a pale, translucent yellow. dark pigment can be seen. The life colors are unknown.
RELATIONSHIP: This species is quite close to *A. beryllinus*, the only er known member of the genus. The two may be readily separated by the racters listed in the key.
HOLOTYPE: København Zoologish Museum number 21.9.1916.562-576; a male, 4 mm. in standard length, collected at St. Thomas, Virgin Islands, on tember 21, 1916. The name of the collector was not listed.
PARATYPES: SU 18101; two specimens, a male 16.2 mm. and a female 18.4 in standard length, both taken with the holotype. København Zoologish eum 21.9.1916.562-576: 11, from 13.1 mm. to 17.9 mm. in standard length, lo taken with the holotype.
DERIVATION OF NAME: The name is from the Latin *amplus*, large; and *cirrus*, st. It refers to the large crest on the border of the anterior nostril, identifying character of this species.

Genus *RIMICOLA* Jordan and Evermann

Figures 34, 62; Map 9

icola Jordan and Evermann *in* Jordan, 1896, p. 331 (type species *Gobiesox muscarum* Meek and Pierson, 1895, by original designation).

Body only a little depressed anteriorly, slender, with snout not pro- ting but continuous with head. Head well depressed, length 3.0-4.0 and th 4.3-6.6 in standard length. A few shallow, fleshy lobes appear be- th lower jaw but not elsewhere on head. Nostrils on each side well sep- ted, distinctly tubular. Upper lip, as delineated by premaxillary ove, comparatively narrow and no wider at front of snout than at sides. Teeth at front of lower jaw well-developed incisors which may be flat- ed, rounded, or pointed at the tips; these followed on each side by 2 to anines (usually weak) and then a row of small conical teeth. A fairly p patch of small conical teeth behind first row. Teeth of upper jaw nted, conical, occurring in a fairly deep patch toward the front. Those corners may be recurved and canine-like.
Five or 6 broad, pointed or blunt rakers on each gill arch. Edges of l membranes attached laterally a short distance in front of upper pec- al base. A small, shallow, fleshy, pectoral pad on lowest portion of toral base; it is without a free, vertical, posterior margin.
Median fins quite short; dorsal rays 6-8, anal rays 6-8, and caudal rays Pectoral rays range from 14-19. Usually first 2 rays in dorsal and

anal fins much reduced and not externally visible, except in very sma specimens in which fin membranes are thin and semi-transparent. For ide tification, when time for dissection or clearing and staining cannot spared, it is usually safe to add 2 to the external dorsal and anal r counts in this genus.

The disc is small, length 5.2-6.7 in standard length, with a characte istic arrangement of the shallow flattened papillae on its ventral surfa (fig. 34). Bony support for disc also characteristic (fig. 62). Pelv girdle comparatively narrow and distal postcleithral bones have a uniq shape.

An external sexual dimorphism is usually apparent in the size and sha of the urogential papillae (fig. 10); this difference is very marked *R. dimorpha*. Also, the anus is located further forward on the body in t males than in the females. Thirty-three to 36 vertebrae are present.

There are four known species in this genus, all found in the North Eas ern Pacific. None have been taken in fresh water.

Artificial Key to the Species of *Rimicola*

1a. Caudal peduncle comparatively deep, least depth 2.2 (1.7-2.6) in i length; the 2 pairs of pores near tip of snout arranged approximate parallel (fig. 5); pectoral rays 18 (17-19).....*eigenmanni* (p. 7

1b. Caudal peduncle comparatively shallow, least depth 2.8-4.2 in i length; the inner pore of each pair near tip of snout lies posteri to the outer; pectoral rays 14-17.

2a. Males with an extensive development of the urogenital papilla, i length about equal to depth of body in region of anus; eye 1.0-1.2 bony interorbital space.....*dimorpha* (p. 7

2b. Males with a very small urogenital papilla, its length much less th depth of body in region of anus; eye 1.2-1.8 in bony interorbit space.

3a. Snout markedly rectangular in dorsal outline (fig. 5); head leng 3.1 (3.0-3.3); pectoral rays 17 (16-17).....*sila* (p. 7

3b. Snout more or less rounded in dorsal outline (fig. 5); head leng 3.6 (3.3-4.0); pectoral rays 15 (14-16), rarely 17..... .....*muscarum* (p. 8

Rimicola eigenmanni (Gilbert)

Figure 5

Gobiesox eigenmanni Gilbert, 1890a, p. 96 (Point Loma, near San Dieg California).

Gobiesox rhessodon Rosa Smith (*non* Rosa Smith, 1881), 1885, p. 553 (S Cristóbal, Baja Calif., Mexico).

Rimicola eigenmanni Jordan, 1896, p. 231, pl. 32.—Jordan and Everman 1896, p. 492 (Point Loma); 1898, p. 2339 (Point Loma; San Cristób Bay).—Snyder, 1908, p. 183 (in part; excluding specimens from nor of Palos Verdes Peninsula).—Jordan, Evermann, and Clark, 1930. 490 (in part; excluding specimens from north of Palos Verdes Peni sula).—Barnhart, 1936, p. 93 (in part; excluding specimens fr north of Palos Verdes Peninsula).—Schultz, 1944, p. 57 (in part; e cluding specimens from north of Palos Verdes Peninsula).—Brigg 1951, p. 62 (in part; excluding specimens from north of Palos Verd Peninsula).—Fitch, 1952, p. 563 (one and one half miles west Arroyo Mesquital, San Juanico, Baja Calif., Mexico).

DIAGNOSIS: A robust *Rimicola* with a comparatively deep caudal pedunc

st depth 2.2 (1.7-2.6) in its length. Eye small, diameter 1.6 (1.3-3.2) oony interorbital space and 5.6 (4.7-8.5) in head. Head width 4.7 (4.3-5.), usually less that 5.0, in standard length. Pores on front of snout anged in a characteristic manner (fig. 5). Dorsal rays 7 (6-8), anal s 8 (7-8), pectoral rays 18 (17-19) and caudal rays 8.

DESCRIPTION: Body only slightly depressed, depth 7.8 (6.6-9.8) in standard length. Anus located well in front of dorsal origin and much closer anal fin origin than to rear margin of disc. Maximum known size 46.0 standard length.

Head fairly well depressed, length 3.4 (3.0-3.6) in standard length. ut rounded in dorsal outline, 2.9 (2.5-3.4) in head. Posterior nostril ve or slightly behind anterior edge of eye; anterior nostril with a minent, simple, dermal flap extending from its posterior margin. Five 6) pairs of flattened, rounded, or slightly pointed incisors at front of er jaw; these followed by 2 or 3 canines and a row of smaller, conical

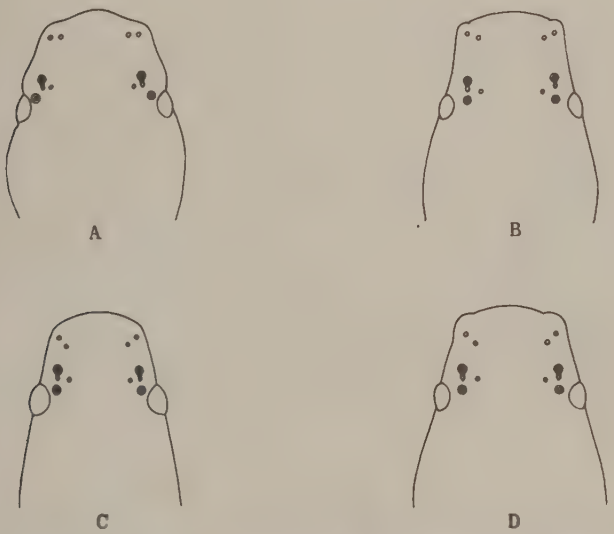


Fig. 5. Dorsal outline of head in the four species of *Rimicola*. A. *R. tenmanni*. B. *R. sila*. C. *R. dimorpha*. D. *R. muscarum*.

th. A fairly deep patch of small, conical teeth behind first row. th of upper jaw pointed, conical, occurring in a fairly deep patch ards the front. Those at corners somewhat recurved and canine-like. h gill arch bears 5 broad, blunt rakers.

Fleshy lobe-like structures present beneath lower jaw but not elsewhere head. The 2 pores which lie farthest forward on top of each side of ut are approximately parallel and situated close to the premaxillary ove (fig. 5). Upper attachment of gill membrane occurs opposite 4th 5) pectoral ray. Subopercular spine poorly developed, not easily iden-ied externally. A small, shallow, fleshy, pectoral pad on lowest por-n of pectoral base; it is without a free, vertical, posterior margin. er attachment of axial dermal flap opposite 9th (8-10) pectoral ray.

Dorsal-caudal distance forward may extend as far as tip of pectoral fin, usually falls short of this appendage; postdorsal-caudal distance 0.6 4-0.9) in dorsal length. Length of disc 5.9 (5.5-6.6) in standard

length; disc region A with 3 (2-4) rows of flattened papillae across i width; 4 (3-5) rows across width of disc region B; 2 (2-3) rows acro width of region C.

COLORATION: In alcohol, all specimens were a pale, translucent yell with no discernable pigment pattern. According to a personal communicati from Dr. Carl L. Hubbs, the colors in life are quite variable. He not that the individuals taken on the surfgrass (*Phyllospadix*) are bright gre and have a longitudinal purplish stripe. However, he observed that tho found on red and brown algae vary from red and brown to a rather dull oli green.

RELATIONSHIP: This is a well-differentiated species and is easily se arated from the other three by the characters given in the key and the d agnosis. Since the material available for examination shows no indicati of intergradation with either *R. muscarum* or *R. dimorpha*, it is recogniz as a full species.

MATERIAL EXAMINED: SIO (not numbered); one specimen, from San Juani Bay, Baja Calif., Mexico. UCLA field number W51-224; 23, from Puerto Ma Arrimo, Cape Eugenia, Sebastián Viscaíno Bay, Baja Calif., Mexico. S (not numbered); one, from Playa María, Sebastián Viscaíno Bay, Baja Calif Mexico. SIO (not numbered) two, from Punta Rocosa, Baja Calif., Mexic SIO (not numbered); three, from Punta Blanca, Baja Calif., Mexico. UC field number W46-2; two, from two miles north of Hondo Canyon, Baja Calif Mexico. UCLA field number W 46-1; four, from two miles south of R Socorro, Baja Calif., Mexico. UCLA field number W46-8; four, from Pun San Telmo, Baja Calif., Mexico. SIO (not numbered); one, from Cape Colnet Baja Calif., Mexico. SIO (not numbered); one, from near mouth of Río S Isidro, Baja Calif., Mexico. SIO (not numbered); one, from south island the Coronado Islands, Baja Calif., Mexico. SIO (not numbered); 28, fr Bird Rock, San Diego, California. CAS 8151; 11363; 11499-11500; 28, al from Bird Rock. SU 7756; one, from La Jolla, California. CAS 11424-1142 two, from a locality between Encinitas and Oceanside, California. SU 3992 two, from Laguna, California.

RANGE: From Arroyo Mesquital, San Juanico Bay, Baja Calif., Mexico, Palos Verdes Peninsula, near San Pedro, California.

REMARKS: Inhabits the tidepools. Not usually found in the kelp be offshore.

Rimicola dimorpha, new species

Figures 5, 95

DIAGNOSIS: A very slender *Rimicola* with an extensive development of t urogenital papilla in the males, its length being about equal to depth body in region of anus. Caudal peduncle comparatively shallow, least dep 3.1 (2.8-3.6) in its length. Eye comparatively large, 1.1 (1.0-1.2) bony interorbital space and 4.9 (4.7-5.2) in head. Head width 5.9 (5. 6.6) in standard length. Dorsal rays 7 (6-7), anal rays 7 (6-8), pector rays 16 (15-16), and caudal rays 8.

DESCRIPTION: Body only a little depressed, depth 9.8 (9.1-10.5) in sta dard length. Anus located well in front of dorsal origin and much clos to anal fin origin than to rear margin of disc.

Head fairly well depressed, length 3.4 (3.2-3.6) in standard lengt Snout in dorsal outline has a somewhat rectangular shape (fig. 5), 3 (3.1-3.4) in head. Posterior nostril behind anterior edge of eye; anteri nostril with a simple, dermal flap extending from its posterior margi Four (3-5) pairs of rounded or slightly pointed incisors at front of low jaw, followed on each side by 3 or 4 weakly developed canines, then a row of small conical teeth. A fairly deep patch of small, conical tee

ind the first row. Teeth of upper jaw pointed, conical, occuring in a rly deep patch toward the front. Five or 6 broad, blunt rakers on each l arch.

Fleshy lobe-like structures present beneath lower jaw out not elsewhere head. One of the 2 pores which lie farthest forward on top of each side snout situated considerably closer to premaxillary groove than the er (fig. 5). Upper attachment of gill membrane occurs opposite 4th (3- pectoral ray. Subopercular spine poorly developed, not easily identified ernally. A small, shallow, fleshy, pectoral pad on lowest portion of toral base; it is without a free, vertical, posterior margin. Upper tachment of axial dermal flap opposite 7th (6-8) pectoral ray.

Dorsal-caudal distance forward may extend as far as distal one-third pectoral fin, but usually falls short of this appendage; postdorsal- dal distance 0.6 (0.4-0.7) in dorsal length. Length of disc 5.9 (5.4- 7) in standard length; disc region A with 3 rows of flattened papillae ross its width; 4 (4-5) rows across width of disc region B; 2 (2-3) rows ross width of region C.

COLORATION: In alcohol, all specimens were a pale, translucent yellow, th no discernable pigment pattern. The life colors are unknown.

RELATIONSHIP: This species is outstanding mainly due to the very slender ad and body and the relatively enormous development of the urogenital pilla in the male. It occurs with *R. eigenmanni*, but may be separ- ed from that species by the pectoral ray count, depth of caudal peduncle, d size of eye, as well as the aforementioned characters.

HOLOTYPE: Stanford University number 18113; a male, 28.5 mm. in standard ngth, collected by Dr. Carl L. Hubbs and party at Punta Clara, south of o Santo Tomás, Baja Calif., Mexico, on December 18, 1945.

PARATYPES: SU 18114; 15 specimens, 15.9 mm. to 29.1 mm. in standard ngth, taken with the holotype. SIO (not numbered); two, 28.6 mm. and .1 mm., from reef near Halfway House, Baja California, Mexico. UCLA eld number W46-2; two, 25.0 mm. and 25.9 mm., from a point two miles rth of Hondo Canyon, Baja Calif., Mexico. UCLA field number W46-3; five, om 24.9 mm. to 28.7 mm., from two miles south of the Río Socorro, Baja lif., Mexico. SIO (not numbered); one, 22.5 mm., from Santo Tomás Bay. O (not numbered); two, 24.2 mm. and 25.0 mm., from a reef north of Río nto Tomás.

REMARKS: Dr. Carl L. Hubbs has reported the capture of a specimen from st San Benito Island, Baja Calif., Mexico. This constitutes the south- nmost record for this species.

DERIVATION OF NAME: The name is from the Greek *dis*, two; and *morphe*, rm, in reference to the sexual differences in the urogenital papillae.

Rimicola sila, new species

Figures 5, 96

DIAGNOSIS: A slender *Rimicola* with a comparatively shallow caudal ped- ncle, least depth 3.2 (2.8-3.6) in its length. Eye comparatively large, 3 (1.2-1.4) in bony interorbital space and 5.2 (4.7-5.9) in head. Head dth 5.2 (4.7-5.7) in standard length. Dorsal rays 7 (6-7), anal rays 7 7-8), pectoral rays 17 (16-17), and caudal rays 8.

DESCRIPTION: Body only a little depressed, depth 8.5 (7.8-9.8) in stan- ard length. Anus located well in front of dorsal origin and much closer anal fin origin than to rear margin of disc.

Head fairly well depressed and long, length 3.1 (3.0-3.3) in standard ength. Snout in dorsal outline has a pronounced rectangular shape (fig.). 3.1 (2.8-3.4) in head. Posterior nostril above or slightly behind nterior edge of eye; anterior nostril with a simple dermal flap extending

from its posterior margin. Three (1-6) pairs of rounded or slight pointed incisors at front of lower jaw; followed on each side by 4 weak developed canines and then a row of small conical teeth. A fairly de patch of small conical teeth behind first row. Teeth of upper jaw pointe conical, occurring in a fairly deep patch toward the front. Five broa pointed rakers on first gill arch.

Fleshy lobe-like structures present beneath lower jaw but not elsewhe on head. One of the 2 pores which lie farthest forward on top of each si of snout situated considerably closer to premaxillary groove than the oth (fig. 5). Upper attachment of gill membrane opposite 4th (4-5) pector ray. Subopercular spine moderately well developed but not pungent. small, shallow, fleshy pectoral pad on lowest portion of pectoral bas it is without a free, vertical, posterior margin. Upper attachment axial dermal flap opposite 8th (7-9) pectoral ray.

Dorsal-caudal distance forward may extend as far as tip of pectoral f but usually falls short of this appendage; postdorsal-caudal distance 0 (0.4-0.8) in dorsal length. Length of disc 5.7 (5.3-6.2) in standa length; disc region A with 3 rows of flattened papillae across its widt 4 (4-5) rows across width of disc region B; 2 (1-3) rows across width region C.

COLORATION: In alcohol, all specimens were a pale, translucent yello with no discernable pigment pattern. The life colors are unknown.

RELATIONSHIP: This isolated form is evidently most closely related *R. muscarum*, a species which, so far, has not been found south of L Angeles, California.

HOLOTYPE: Stanford University number 18116; a male, 23.6 mm. in standa length, collected by Dr. Carl L. Hubbs and party, at Melpomene Cove on t south end of Guadalupe Island, Mexico, on February 1, 1950.

PARATYPES: SU 18117; seven specimens, 20.4 mm. to 28.0 mm. in standa length, all taken with the holotype.

DERIVATION OF NAME: The name is from the Latin *silus*, snub-nosed, reference to the cut-off appearance of the snout.

Rimicola muscarum (Meek and Pierson)

Figures 5, 10

Gobiesox muscarum Meek and Pierson, 1895, p. 571, pl. 71 (Monterey Ba Calif.).

Rimicola muscarum Jordan, 1896, p. 231.—Jordan and Evermann, 1896, p. 4 (Monterey Bay); 1898, p. 2338 (Monterey Bay).

Rimicola eigenmanni (*non* Gilbert) Wilby, 1936, p. 116 (Round Island Flat Clayoquot Sound, British Columbia).

DIAGNOSIS: A slender *Rimicola* with a comparatively shallow caudal pe uncle, least depth 3.3 (2.8-4.2) it its length. Eye fairly small, diamet 1.4 (1.2-1.8) in bony interorbital space and 5.4 (4.8-6.8) in head. He width 5.5 (4.7-6.1), usually more than 5.0 in standard length. Dorsal ra 7 (6-8), anal rays 7 (6-8), pectoral rays 15 (14-16), rarely 17, and caud rays 8.

DESCRIPTION: Body only a little depressed, depth 9.3 (7.0-10.3) in sta dard length. Anus located well in front of dorsal origin and much clos to anal fin origin than to rear margin of disc. Maximum known size 53 mm. standard length.

Head fairly well depressed, length 3.6 (3.3-4.0) in standard lengt Snout in dorsal outline somewhat rectangular in the smaller specimens b rounded in the larger, 3.2 (2.8-3.4) in head. Posterior nostril above

ghtly behind anterior edge of eye; anterior nostril with a simple, der- flap extending from its posterior margin. Four (3-5) pairs of flat- ed, rounded, or slightly pointed incisors at front of lower jaw, fol- ed on each side by 2 prominent canines and then a row of small conical eth. A fairly deep patch of small, conical teeth behind first row. th of upper jaw pointed, conical, occurring in a fairly deep patch to- d the front. Those at corners recurved and canine-like. Each gill h bearing 5 broad, blunt rakers.

Fleshy lobe-like structures present beneath lower jaw but not elsewhere head. Only 1 of the 2 pores which lie farthest forward on top of each ie of snout situated close to premaxillary groove (fig. 5). Upper achment of gill membrane occurs opposite 4th (2-5) pectoral ray. Sub- ercular spine poorly developed, not easily identified externally. A ll, shallow, fleshy, pectoral pad on lowest portion of pectoral base; it without a free, vertical, posterior margin. Upper attachment of axial mal flap opposite 7th (6-8) pectoral ray.

Dorsal-caudal distance forward may extend as far as tip of pectoral fin t usually falls short of this appendage; postdorsal-caudal distance 0.6 .4-0.7) in dorsal length. Length of disc 5.7 (5.4-6.3) in standard ngth; disc region A with 3 (3-4) rows of flattened papillae across its dth; 4 (4-5) rows across width of disc region B; 2 (2-3) rows across dth of region C.

COLORATION: In alcohol, all specimens were a pale, translucent yellow, th no discernable pigment pattern. As in the case of *R. eigenmanni*, the fe colors are apparently quite variable. The specimens reported by Wilby 936, p. 116) from British Columbia were a vivid green with no spotting or her color. Snyder (1908, p. 183) stated that specimens observed at Pac- ic Grove, California, strongly resembled in color the brownish kelp *ereocystis* sp.) upon which they were found. In the original description Meek and Pierson (1895, p. 571), the color was given from an alcohol ecimen (evidently freshly preserved) as a yellowish body with distinct ownish-red spots and a lateral stripe of the same color. The holotype is w entirely without coloration.

RELATIONSHIP: This species is easily separated from the two mainland rms which are found farther south. It was interesting to find that its osest relative in the genus is apparently *R. sila*, the endemic Guadalupe land species. The latter form tends to have more pectoral rays, and ssesses an obviously more square-cut snout (from a dorsal view), and a nger head, otherwise they could be separated only with great difficulty.

MATERIAL EXAMINED: CAS (not numbered); three specimens, from White's int, Los Angeles County, California. CAS (not numbered); two, from Santa sa Island, California. CAS (not numbered); five, from Point Arguello, lifornia. SU 7974; 13, from Point Lobos, California. SU 3030; one olotype of *R. muscarum*), from Monterey, California.

RANGE: Bird Rock near La Jolla, San Diego County, California to Round land Flats, Clayoquot Sound, British Columbia.

REMARKS: Inhabits the kelp beds. Rarely found in tide pools.

Genus *ARCOS* Schultz

Figures 11, 35, 63; Map 10

rcos Schultz, 1944, p. 71 (type species *Gobiesox erythrops* Jordan and Gilbert, 1882, by original designation).

Body greatly depressed anteriorly; tadpole-shaped in dorsal outline with

snout not projecting but continuous with head. Head greatly depressed length 2.2-2.4 and width 2.2-2.7 in standard length. A few shallow, fles lobes beneath lower jaw but not elsewhere on head. Nostrils on each si well separated, distinctly tubular. Upper lip, as delineated by prema illary groove, wide at front of snout, narrowing abruptly at the sides.

A deep patch of irregularly placed teeth at front of each jaw. Th anteriormost are rounded incisors, those of lower jaw the more strongl compressed. Incisors of lower jaw followed on each side by 1-4 canines Canines in upper jaw in only one species (*A. erythrops*), where they a poorly developed. Six broad, blunt rakers on second gill arch. Gill mem branes attached laterally a short distance in front of upper pectoral bas A well-developed, fleshy pad on outer pectoral base, with a free posteri margin which does not extend dorsally as far as gill-membrane attachment

Median fins quite short; dorsal rays 6-8, anal rays 5-7, and caudal ra 6-10. Pectoral rays range from 20-24. Usually first ray in dorsal a anal fins much reduced, not externally visible, except in very small spec mens in which fin membranes are thin and semi-transparent. For identif cation, when time for dissection or clearing and staining cannot be spare it is usually safe to add one to the external dorsal and anal ray count in this genus.

Disc very large, length 2.3-2.9 in standard length, with a characte istic arrangement of the shallow, flattened papillae on its ventral surfa (fig. 35). Bony support for this structure also characteristic (fig. 63 Pelvic girdle comparatively broad and distal postcleithral bones have unique shape.

The life color of the dorsal side of the body is predominantly red.

An external sexual dimorphism is apparent in the size and shape of th urogenital papilla (fig. 11). Vertebrae 26.

There are four known species in this genus, three in the Eastern Pacif and one in the Western Atlantic. None has been taken in fresh water.

Artificial Key to the Species of *Arcos*

1a. Pectoral rays 20-22; dorsal rays 6-7[1]; postdorsal-caudal distance dorsal length 0.6-0.9.

2a. Eye 0.6-0.7 in bony interorbital space; disc 2.7-2.9 in standa length; 5-8 rows of flattened papillae across width of disc region 7-9 rows across width of disc region B.....*rhodospilus* (p. 8

2b. Eye 0.3-0.5 in bony interorbital space; disc 2.3-2.4 in standa length; 9-14 rows of flattened papillae across width of disc region 11-14 rows across width of disc region B.....*erythrops* (p. 8

1b. Pectoral rays 23-24; dorsal rays 8[1]; postdorsal-caudal distance dorsal length 0.9-1.4.

3a. A single large canine following the incisors on each side of low jaw; greatest diameter of eye 0.7-0.8 in bony interorbital space; fr posterior margin on fleshy pectoral pad extends dorsally as far 16th-18th pectoral ray; 9 longitudinal rows of flattened papill across each part of disc region C.....*macrophthalmus* (p. 8

3b. Three to 4 canines following the incisors on each side of lower j greatest diameter of eye 0.5-0.6 in bony interorbital space; fr posterior margin on fleshy pectoral pad extends dorsally as far 12th-14th pectoral ray; 5-7 longitudinal rows of flattened papill across each part of disc region C.....*poecilophthalmus* (p. 8

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[1]Add one if dorsal rays are counted without dissection.

Arcos rhodospilus (Günther)

esox rhodospilus Günther, 1864, p. 25 (Pacific coast of Panama); 1869, pp. 390, 445 (Panama).—Jordan and Evermann, 1896, p. 492 (Panama); 1898, p. 2335 (Panama).—Boulenger, 1899, p. 8 (Santa Elena Bay, Ecuador).—Gilbert and Starks, 1904, p. 189 (Panama).—Meek and Hildebrand, 1928, p. 926 (Panama and Santa Elena Bay).—Jordan, Evermann and Clark, 1930, p. 489 (Panama).—Fowler, 1944b, p. 525 (Jacarita Island, Panama).—Briggs, 1951, p. 69 (the Pacific coast of Panama).

DIAGNOSIS: An *Arcos* without canines in the upper jaw and with 5 (4-6) rs of incisors in the lower jaw. Length of the disc 2.8 (2.7-2.9) in tdard length. Postdorsal-caudal distance extends 0.8 (0.7-0.9) times in gth of dorsal fin. Eye 0.7 (0.6-0.7) in bony interorbital space and 3.6 2-3.8) in head. Dorsal rays 7 (6-7), anal rays 6 (5-7), pectoral rays (20-22), and caudal rays 8.

DESCRIPTION: Body highly depressed, depth 6.1 (5.3-6.8) in standard gth. Caudal peduncle long, least depth 1.8 (1.7-2.0) in its length. ns located well in front of dorsal origin and much closer to rear margin disc than to anal fin origin. Maximum known size 37.1 mm. standard gth.

Head highly depressed and long, length 2.3 (2.2-2.4) and width 2.6 (2.5-.) in standard length. Snout shallow with a slightly rounded outline, (3.5-3.8) in head. Posterior nostril behind anterior edge of eye; erior nostril with a medium-sized (less than one-half the pupil), nched, dermal flap extending from its posterior margin. Incisors at nt of lower jaw followed on each side by 3 (2-4) canines. Teeth of er jaw all somewhat compressed and incisor-like; no canines or conical th present. Six comparatively broad, blunt rakers on second gill arch. The fleshy, lobe-like structures beneath lower jaw have a characteristic pattern. Upper attachment of gill membrane opposite 4th (3-5) pectal ray. Subopercular spine well developed; it protrudes upon application of a little pressure. Fleshy pad on pectoral base conspicuous, with ree posterior margin extending from lowest part of pectoral base dorsally as far as 12th (11-13) pectoral ray. Upper attachment of axial derm flap opposite 8th (7-10) pectoral ray.

Dorsal-caudal distance forward extends well in front of tip of pectoral . Each part of disc region C bears 6 (5-7) longitudinal rows of palae; there are 7(5-8) rows across width of disc region A, and 8 (7-9) ws across width of region B.

COLORATION: In alcohol, the entire body is usually very pale and transent, with no sign of pigmentation. In life, this species is reported to reddish or rose colored.

RELATIONSHIP: As is evident in the key and descriptions, this species is l separated from the Galápagos form, and yet it is comparatively close graphically. Its nearest relative is *Arcos erythrops*, which occurs farr to the north.

MATERIAL EXAMINED: SU 18106; one specimen, from Santa Elena Bay, Ecua-. BM 1863.12.16.58-59; two (syntypes of *Gobiesox rhodospilus*), from the ific coast of Panama. SU 18109-18110; five, from Uvita Bay, Costa Rica. 18108; ten, from Piedra Blanca Bay, Costa Rica. SU 18107; one, from rero Grande Bay, Costa Rica.

RANGE: Santa Elena Bay, Ecuador, to Potrero Grande Bay, Costa Rica.

Arcos erythrops (Jordan and Gilbert)

Figure 97

Gobiesox erythrops Jordan and Gilbert, 1882a, p. 360 (Mazatlán). —Jor and Evermann, 1896, p. 491 (Mazatlán; Tres Marías Islands); 1898, 2336 (Mazatlán; Tres Marías Islands). —Jordan, Evermann, and Cla 1930, p. 490 (Mazatlán; Tres Marías Islands).

Arcos superoculus Briggs, 1951, p. 96, figs. 21, 22, 23 (Tres Marías lands).

DIAGNOSIS: An *Arcos* with canines in upper jaw and with 4 (4-5) pairs incisors in lower jaw. Length of disc 2.3 (2.3-2.4) in standard leng Postdorsal-caudal distance extends 0.7 (0.6-0.8) times in length of dor fin. Eye 0.4 (0.3-0.5) in bony interorbital space and 3.8 (3.3-4.2) head. Dorsal rays 7 (6-7), anal rays 6, pectoral rays 21 (21-22), and c dal rays 8 (7-8).

DESCRIPTION: Body highly depressed, depth 6.1 (5.5-6.6) in stand length. Caudal peduncle long, least depth 1.9 (1.8-2.1) in its leng Anus located well in front of dorsal origin and much closer to rear mar of disc than to anal fin origin. Maximum known size 42.2 mm. stand length.

Head highly depressed and long, length 2.6 (2.5-2.7) and width (2.5-2.8) in standard length. Snout fairly shallow with a rounded outli 3.8 (3.4-4.1) in head. Posterior nostril behind anterior edge of e anterior nostril with a medium-to-small, branched dermal flap extend from its posterior margin. Incisors at front of lower jaw, followed each side by 3 (3-4) canines. Teeth at front of upper jaw 3 (2-4) pairs lightly compressed incisors, followed on each side by 3 (2-4) weak cani (these may be absent in the smallest specimens). Six comparatively bro blunt rakers on second gill arch.

The fleshy, lobe-like structures beneath the lower jaw have a char teristic pattern. Upper attachment of gill membrane opposite 4th 5) pectoral ray. Subopercular spine well developed; it protrudes u application of a little pressure. Fleshy pad on pectoral base conspicuo with a free posterior margin extending from lowest part of pectoral b dorsally as far as 11th (11-12) pectoral ray. Upper attachment of ax dermal flap opposite 7th (6-8) pectoral ray.

Dorsal-caudal distance forward extends well in front of tip of pecto fin. Length of disc 2.3 (2.3-2.4) in standard length; each part of d region C bears 8 (7-9) longitudinal rows of papillae; there are 10 (9- rows across width of disc region A, and 12 (11-14) rows across width region B.

COLORATION: In alcohol, the entire body is usually very pale and tra lucent, with no sign of pigmentation. In life, the body has three or f bars of cherry red. The head and eyes are said to show this same red c oration.

RELATIONSHIP: I consider this species to be the most specialized in genus, principally because of the presence of weak canines at the sides the upper jaw (in addition to the incisors, which are also found in other two forms). It may be further separated by size of eye, width head, and length of disc.

MATERIAL EXAMINED: SU 18104; one specimen, from Puerto Guatulco, Oaxa Mexico. SIO (not numbered); 12, from Puerto Marques near Acapulco, Gu rero, Mexico. SU 18102-18103; three, from Chamela Bay, Jalisco, Mexi SU 16395-16396; two (paratypes of *Arcos superoculus*), from Tres Mar Islands, Mexico. SU 16394; one (holotype of *A. superoculus*), from the T

as Islands, Mexico. CAS 12058; one, from Mazatlán, Sinaloa, Mexico. 9385; 47181; 3, from San Lucas Bay, Baja Calif., Mexico. HF 611; seven, Los Frailes, Baja Calif., Mexico.

ANGE: Puerto Guatulco, Oaxaca, Mexico, to Guaymas, Sonora, Mexico.

EMARKS: In a previous paper the author (Briggs, 1951, p. 96) listed the e of *A. poecilophthalmus* as extending north to Mazatlán, Sinaloa, Mex- The basis of the Mazatlán record was a very poorly preserved specimen he California Academy of Sciences Collection (CAS 12058). Comparison recently acquired material from the Gulf of California and Southern co has proved the identification to be erroneous, and shows that the imen is a representative of *A. erythrops*. *A. superoculus* was described ew because it was thought, as a result of the abovementioned misidenti- tion, that *A. erythrops* was a synonym of *A. poecilophthalmus*. Fortun- y, it is now possible to clarify the relationships in this genus by nymizing *A. superoculus*, correcting the known range of *A. poecilophh- mus*, and recognizing the existence of the tropical Pacific species *A. lospilus*.

Arcos macrophthalmus (Günther)

esox macrophthalmus Günther, 1861, p. 502 (locality unknown). —Jordan and Evermann, 1898, p. 2335 (locality unknown; probably West Indies). —Metzelaar, 1922, p. 140 (Caracasbay). —Jordan, Evermann, and Clark, 1930, p. 489 (probably West Indies).

esox cerasinus Cope, 1871, p. 413 (St. Martins, West Indies). —Jordan and Evermann, 1896, p. 492 (St. Martins); 1898, p. 2336 (St. Martins). —Silvester, 1916, p. 216 (near Guanica Harbor, Puerto Rico). —Fowler, 1919, p. 143 (St. Martins). —?Metzelaar, 1922, p. 140 (Caracasbay). —Jordan, Evermann, and Clark, 1930, p. 489 (St. Martins, West Indies).

)IAGNOSIS: An *Arcos* without canines in upper jaw and with 3 pairs of sors in lower jaw. Length of disc 2.6 (2.5-2.6) in standard length. dorsal-caudal distance extends 1.0 (0.9-1.0) times in length of dorsal Eye 0.7 (0.6-0.8) in bony interorbital space and 4.4 (3.9-4.7) in d. Dorsal rays 8 (7-8), anal rays 7 (6-7), pectoral rays 24 (23-25), caudal rays 10.

)ESCRIPTION: Body highly depressed, depth 5.5 (5.2-5.8) in standard gth. Caudal peduncle medium, least depth 1.6 (1.5-1.7) in its length. s located well in front of dorsal origin, and much closer to rear margin disc than to anal fin origin. Maximum known size 59.2 mm. standard gth.

Head highly depressed and long, length 2.2 and width 2.3 (2.2-2.4) in ndard length. Snout shallow with a slightly rounded outline, 3.6 (3.3- in head. Anterior nostril with a large, branched dermal flap extend- from its posterior margin. Incisors at front of lower jaw followed on n side by a single large canine, then 4 small conical teeth. Teeth of er jaw in a deep patch, all somewhat compressed and incisor-like; no ines or conical teeth present.

The fleshy, lobe-like structures beneath lower jaw have a characteristic tern. Upper attachment of gill membrane occurs opposite 3rd (2-5) pec- al ray. Subopercular spine well developed; it protrudes upon applica- n of pressure. Fleshy pad on pectoral base conspicuous, with a free terior margin extending from the lowest part of pectoral base dorsally far as 16th (15-18) pectoral ray. Upper attachment of axial dermal flap posite 10th (9-10) pectoral ray.

Dorsal-caudal distance forward extends to proximal half of pectoral fin.

Each part of disc region C bears 9 (8-9) longitudinal rows of papil there are 11 (10-13) rows across width of disc region A, and 12 (11 rows across width of disc region B.

COLORATION: In alcohol, the entire body is very pale and transluc with no sign of pigmentation. In life, this species is reported to be dominantly red.

RELATIONSHIP: It was interesting to find that this fish is appare most closely related to *Arcos poecilophthalmus*, the species confined to Galápagos Islands, rather than to *A. rhodospilus*, the West Panamanian f The two species are easily separated by a number of external morpholog characters.

MATERIAL EXAMINED: AM (not numbered); one specimen from Caracas Curaçao Island, Netherlands West Indies. KZM 21.9.1916.557; one, from Virgin Islands. BM 1861.8.14.42-43; two specimens (syntypes of *Gobi macrophthalmus*), from an unknown locality. The larger and better prese specimen is hereby designated the lectotype of this species. The sma specimen belongs to a different genus (*Acyrtus*). There is no doubt t these specimens were collected somewhere in or close to the West Ind ANSP 10363; one (holotype of *Gobiesox cerasinus*), from St. Martin Isl West Indies.

RANGE: Curaçao Island, Netherlands West Indies, to Puerto Rico.

Arcos poecilophthalmus (Jenyns)

Gobiesox poecilophthalmus Jenyns, 1842, p. 141, pl. 27, figs. 2, 2a, (Chatham Island).—Günther, 1861, p. 503 (Chatham Island).—Jor and Evermann, 1896, p. 491 (Chatham Island); 1898, p. 2335 (Cha Island).

Tomicodon poecilopthalmus Brisout de Barneville, 1846a, p. 144.

Cotylis poecilophthalmus Müller and Troschel, 1849, p. 19 (Galápagos)

Gobiesox paradiseus Herre, 1935, p. 432 (Eden Island; South Seymour land); 1936, p. 393, fig. 36 (Eden Island; South Seymour Island)

Gobiesox erythrops (*non* Jordan and Gilbert) Fowler, 1938, p. 260 (Cha Island).

Arcos poecilophthalmus Schultz, 1944, p. 72 (in part; Galápagos speci only).—Briggs, 1951, p. 96, fig. 20 (in part; Galápagos speci only).

DIAGNOSIS: An *Arcos* without canines in upper jaw and with only 2 (pairs of incisors in lower jaw. Length of disc 2.5 (2.4-2.6) in stan length. Postdorsal-caudal distance extends 1.2 (0.9-1.4) times in le of dorsal fin. Eye 0.6 (0.5-0.6) in bony interorbital space and 3.7 (4.2) in head. Dorsal rays 8, anal rays 7, pectoral rays 23 (23-24), caudal rays 9 (8-10).

DESCRIPTION: Body highly depressed, depth 6.1 (5.5-6.4) in stan length. Caudal peduncle medium, least depth 1.6 (1.4-1.8) in its len Anus located well in front of dorsal origin and much closer to rear ma of disc than to anal fin origin. Maximum known size 45.8 mm. stan length.

Head highly depressed and long, length 2.3 (2.2-2.3) and width 2.4 (2.6) in standard length. Snout shallow with a rounded outline, 3.7 (3.8) in head. Posterior nostril behind anterior edge of eye; anterior tril with a large, branched dermal flap extending from its posterior gin. Incisors at front of lower jaw followed on each side by 3 (3-4) ines. Teeth of upper jaw all compressed incisors; no canines or con teeth present. Six comparatively broad, blunt rakers on each gill arch

The fleshy lobe-like structures beneath lower jaw have a characteri

ern. Upper attachment of gill membrane opposite 4th (3-4) pectoral
Subopercular spine well developed; it protrudes upon application of a
le pressure. Fleshy pad on pectoral base conspicuous, with a free
erior margin extending from lowest part of pectoral base dorsally as
as 13th (12-14) pectoral ray. Upper attachment of axial dermal flap
site 9th (8-10) pectoral ray.
orsal-caudal distance forward usually extends well in front of tip of
oral fin. Each part of disc region C bears 6 (5-7) longitudinal rows
apillae; there are 11 (10-12) rows across width of disc region A, and
10-11) rows across width of disc region B.
OLORATION: In alcohol, the entire body is very pale and translucent,
no sign of pigmentation. In life, this species is reputed to be a
ht red color.
ELATIONSHIP: This is a very distinct form and is readily separated by
erences in the numbers of dorsal and pectoral rays, size of disc,
th of dorsal fin, development of dermal flap on anterior nostril, size
ye, and in some details of the dentition.
ATERIAL EXAMINED: SU 24422; one specimen (a paratype of *Gobiesox para-
us*), from South Seymour Island, Galápagos. SU 37555; four, also from
h Seymour Island. SU 8093; three, from Isabela Island, Galápagos. BM
.7.14.70; one (holotype of *Gobiesox poecilophthalmus*) from San Cris-
l Island, Galápagos.
ANGE: Galápagos Islands.
EMARKS: See remarks under *A. erythrops* in regard to records of this
ies outside the Galápagos Archipelago.

Genus *GOBIESOX* Lacépède

Figures 1, 36, 64; Map 11

esox Lacépède, 1800, p. 595, fig. 1 (type species *Gobiesox cephalus* Lacépède, by monotypy).
phalus Rafinesque, 1815, p. 86 (type species *Gobiesox cephalus* Lacépède, 1800, by monotypy).
lis Müller and Troschel *in* Müller, 1843, p. 297 (type species *Lepadogaster nudus* Bloch and Schneider, 1801, by subsequent designation of Jordan, 1919c, p. 215).
logaster Brisout de Barneville, 1846a, p. 144 (type species *Gobiesox marmoratus* Jenyns, 1842, by monotypy).
larchus Gill, 1862, p. 330 (type species *Lepadogaster reticulatus* Girard, 1854, by monotypy).
ssetaeres Jordan and Evermann *in* Jordan, 1896, p. 230 (type species *Gobiesox pinniger* Gilbert, 1890, by original designation).
listius Jordan and Evermann, 1896, p. 491 (a subgenus; type species *Gobiesox papillifer* Gilbert, 1890, by original designation).
ssophilus Jordan and Evermann, 1898, p. 2329 (a subgenus; type species *Gobiesox papillifer* Gilbert, 1890, by monotypy).
lichthys Jordan, 1919a, p. 341 (type species *Cotylis fimbriata* Müller and Troschel, 1849, by original designation).
atridens Schultz, 1944, p. 57 (type species *Gobiesox rhessodon* Rosa Smith, 1881, by original designation).

As in many fish groups, the size is quite large in those species regarded most primitive and much smaller in those more highly evolved. Body very ad and depressed anteriorly; tadpole-shaped in dorsal outline with snout projecting but continuous with head. Head large and highly depressed, gth 2.1-2.8 and width 2.3-3.5 (usually less than 3.0) in standard

length. Anus in about middle one-third of distance from rear margin disc to anal fin origin in more primitive species, and close to anal fin igin in the most specialized. The number and relative size of the sens papillae on head vary greatly, but is quite constant within the speci The development of these structures seems to be proportional to phyle position, ranging from very shallow lobes in unspecialized forms to lo sometimes finger-like, projections in the most advanced.

Nostrils on each side well separated, distinctly tubular (except for *potamius*, in which the anterior nostril only is tubular); posterior nost lies just in front of anterior edge of eye in the most primitive speci and usually directly above anterior eye edge in the more advanced. shape of upper lip, as delineated by premaxillary groove, is charact istic, being very wide at the front and rapidly narrowing at the sides snout.

Teeth at front of lower jaw compressed incisors with flat, rounded, t fid, or pointed tips; followed on each side by a row of more or less curved canines. A row of very small conical teeth in lower jaw behind, roughly parallel to, the front incisors in all but the four most primit species (*G. nudus*, *G. juradoensis*, *G. potamius*, and *G. fulvus*), where t are absent. Replacement of teeth, at least in the lower jaw, eviden takes place from the front. Frequently, the juvenile incisors have tri tips, but are replaced by teeth with rounded edges. Trifid incisors found in apparently mature specimens of three species: *G. rhessodon*, *aethus*, and *G. canidens*. Sometimes, in other species, the replacement cisors may have a very shallow trifid structure which is lost with a presumably through wear at the cutting edge. Teeth at front of upper usually more or less conical, the larger at the front, irregular in sition, and forming a comparatively deep patch. In some primitive speci notably *G. potamius*, *G. nudus*, *G. rhessodon*, and *G. maeandricus*, the front teeth are somewhat compressed and rounded, but never as much so the opposing teeth in the lower jaw. These followed on each side by c ines or more conical teeth.

Six to 9 shallow, pointed rakers on each of the two posterior gill ar es. The first arch usually with 1 or 2 fewer and more poorly develo rakers. Gill membranes attached laterally very close to pectoral fin ba This attachment occurs close to top of pectoral fin base in the primit forms, and lower down in those considered more advanced.

A characteristic fleshy pad present on the outer pectoral base; it ha free, vertical, posterior margin which extends from lowest part of pecto base dorsally only as far as upper one-half of pectoral fin in the uns cialized species, but to a point opposite upper gill-membrane attachment the more advanced.

The dorsal, anal, and pectoral fins tend to be quite short in those s cies regarded as primitive and, in general, show some increase in ray co with advancement in the phyletic progression. Dorsal rays 8-20, anal r 6-15, and pectoral rays 18-27. The number of principal caudal rays (th with free tips) remains fairly constant within the group, ranging only f 9-13. Usually the first 2 dorsal and anal rays are very much reduced, are not externally visible except on comparatively small specimens in wh the fin membranes are thin and semi-transparent. Sometimes only the fi ray in each fin is so reduced, as is the case in some examples of *G. str osus*, and even more rarely 3 such reduced rays occur. The exact number be ascertained by careful dissection, or, more accurately, by clearing staining. For identification, when time for dissection or clearing staining cannot be spared, it is usually safe to add 2 to the external d sal and anal ray counts in this genus.

Disc relatively large, length 2.5-3.4 in standard length, and wit characteristic arrangement of the shallow, flattened papillae on its v

t surface (fig. 36). Bony support for the disc also characteristic
i 64). Pelvic girdle comparatively broad and the distal postcleithral
ts have a unique shape.
o externally obvious sexual dimorphism was seen. The number of ver-
rae varies from 25-32, and seems to be better correlated with geographic
ction than with evolutionary progression.
here are 26 known species in the group including those described as new
his paper. The genus is confined entirely to the New World, four spe-
s being found in the Western Atlantic and its fresh-water tributaries,
22 species in the Eastern Pacific and tributaries. The four species
idered most primitive are evidently confined to tropical fresh-water
ams (*G. nudus*, *G. juradoensis*, *G. potamius*, and *G. fulvus*). As far as
nown, the remaining 22 species prefer a marine habitat, although some
be found in brackish water.

Artificial Key to the Species of *Gobiesox*[1]

1. Central margin of upper lip without shallow lobes, or, if present, the free posterior margin on fleshy pectoral pad is incomplete, not extending as far dorsally as upper gill-membrane attachment.
2. Dorsal short, 8-10 rays.
3. Posterior nostril directly above anterior edge of eye; head length 2.8 (2.7-2.8) and width 3.2 (3.0-3.5) in standard length; 2 rows of teeth in lower jaw..... *stenocephalus* (p. 92)
3'. Posterior nostril in front of anterior edge of eye; head length 2.1-2.6 and width 2.3-3.1 in standard length; one row of teeth in lower jaw.
4a. Teeth at front of upper jaw compressed and incisor-like with rounded tips; body depth 5.8-6.5 in standard length; color of dorsal side either light brown or blackish.
5a. Four pairs of incisors at front of lower jaw with flat tips; posterior nostril non-tubular; postdorsal-caudal distance 1.0 (0.8-1.1) in dorsal length..... *potamius* (p. 93)
5b. Five to 7 pairs of incisors at front of lower jaw with rounded tips; posterior nostril tubular; postdorsal-caudal distance 1.3 (1.1-1.6) in dorsal length..... *nudus* (p. 94)
4b. Teeth at front of upper jaw conical, showing little or no compression, with bluntly pointed tips; body depth 4.2-5.7 in standard length; color of dorsal side an even, dark red-brown, sometimes with a few lighter reticulations.
6a. Eye usually 1.1 (0.7-1.2) in bony interorbital space; 5 (5-6) rows of papillae across width of disc region A; fleshy pad on pectoral base with free posterior margin usually extending dorsally only as far as a point well below upper gill-membrane attachment..... ..... *juradoensis* (p. 96)
6b. Eye usually 1.4 (1.3-1.4) in bony interorbital space; 7 (6-7) rows of papillae across width of disc region A; fleshy pad on pectoral base with free posterior margin usually extending dorsally to a point opposite upper gill-membrane attachment.... *fulvus* (p. 97)
2'. Dorsal longer, 11-20 rays.
1a. Free posterior margin on fleshy pectoral pad incomplete, not extending dorsally as far as upper gill-membrane attachment.
3a. Anus closer to rear margin of disc than to anal fin origin; 6 rows of papillae across width of disc region A..... *marmoratus* (p. 98)

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[1] two to both dorsal and anal ray counts if these fins are not dissected.

8b. Anus closer to anal fin origin than to rear margin of disc; 7-9 ro of papillae across width of disc region A.

9a. Eye 0.9 (0.8-1.0) in bony interorbital space; posterior nostr directly above anterior edge of eye; 12 (11-13) rays in anal fi ..... *eugrammus* (p. 10

9b. Eye 1.4 (1.2-1.9) in bony interorbital space; posterior nostr just in front of anterior edge of eye; 14 (13-15) rays in an fin ..... *maeandricus* (p. 10

7b. Free posterior margin on fleshy pectoral pad complete, extendi dorsally to a point opposite upper gill-membrane attachment.

10a. Lower incisors with a strong trifid structure in specimens of a sizes; canines at sides of upper jaw well developed; upper gil membrane attachment at a point opposite 5th pectoral ray..... ..... *rhessodon* (p. 10

10b. Lower incisors may have a very shallow trifid structure in t young but are rounded or with shallow, simple points in the larg specimens; canines, if present at sides of upper jaw, weakly d veloped; upper attachment of gill membrane at a point opposite 5t 9th pectoral ray.

11a. Anus much closer to rear margin of disc than to anal fin origi each lobe of bilobed dermal flap extending from posterior marg of anterior nostril divided into several well-separated points ..... *nigripinnis* (p. 10

11b. Anus midway between rear margin of disc and anal fin origin closer to latter structure; each lobe of bilobed dermal flap e tending from posterior margin of anterior nostril undivided.

12a. Dorsal long with 19 (18-20) rays..... *schultzi* (p. 10

12b. Dorsal shorter with 11-13 rays.

13a. Four to 6 pairs of narrow incisors at front of lower jaw; cha acteristic color pattern of small, distinct dark spots on dors side of head which are usually also found on the iris; disc 2 (2.5-2.7) in standard length..... *punctulatus* (p. 10

13b. Three pairs of comparatively wide incisors at front of low jaw; no distinct dark spots on dorsal side of head or iris; di 2.7-3.3 in standard length.

14a. Disc 3.2 (3.1-3.3) in standard length; 4 (4-5) rows of papill across width of disc region A; head width 2.9 (2.7-3.1) standard length; eye 5.0 (4.3-5.4) in head..... ..... *daedaleus daedaleus* (p. 10

14b. Disc 2.8 (2.7-3.0) in standard length; 6 (5-7) rows of papill across width of disc region A; head width 2.6 (2.4-2.7) standard length; eye 5.5 (5.0-6.0) in head..... ..... *daedaleus brachysoma* (p. 10

1b. Central margin of upper lip marked by protrusions ranging from ve shallow lobes to well-defined papillae; fleshy pad on pectoral ba with free posterior margin extending to a point opposite gill-me brane attachment.

15a. Anus located in about middle one-third of distance from rear marg of disc to anal fin origin; no small papillae at center of upper l between margin and premaxillary groove.

16a. Dorsal long with 18 (16-19) rays..... *pinniger* (p. 11

16b. Dorsal shorter with 10-13 rays.

17a. Lower incisors with a well-defined trifid structure in both you and adults.

18a. Pectoral rays 23; disc 2.9 in standard length; body depth 7.3 standard length; very light dorsal surface with many minute re brown spots..... *aethus* (p. 11

18b. Pectoral rays 22 (21-22); disc 3.1 (3.1-3.2) in standard length; body depth 8.1 (7.6-8.6) in standard length; dorsal surface a very dark, blackish-brown.....*canidens* (p. 114)

17b. Lower incisors may have a very shallow trifid structure in the young (individuals usually less than 29.0 mm. in standard length), but round or with a shallow, simple point in adults (individuals usually over 29.0 mm. standard length).

19a. Anus much closer to anal fin origin than to rear margin of disc... .....*strumosus* (p. 115)

19b. Anus about midway between anal fin origin and rear margin of disc or closer to latter structure.

20a. Upper attachment of gill membrane opposite 5th pectoral ray; anus closer to rear margin of disc than to anal fin origin; snout 3.8 in head length; disc 3.2 in standard length; body depth 7.3 in standard length.....*woodsi* (p. 117)

20b. Upper attachment of gill membrane opposite 6th-8th pectoral ray; anus about midway between rear margin of disc and anal fin origin; snout 2.7-3.2 in head length; disc 2.6-3.2 in standard length; body depth 4.8-7.5 in standard length.

21a. Anus located well in front of dorsal fin origin; each part of disc region C bears 5 (4-7) longitudinal rows of papillae; dorsal fin origin closer to caudal base than to upper pectoral base or equidistant between the two; body depth 6.5 (5.7-7.5) in standard length.....*adustus* (p. 118)

21b. Anus located just in front of dorsal fin origin or under first 1 or 2 dorsal rays; each part of disc region C bears 1-4, usually 2-3, longitudinal rows of papillae; dorsal origin closer to upper pectoral base than to caudal base, or equidistant between the two; body depth 4.8-6.9.

22a. Posterior nostril just in front of anterior edge of eye; eye 1.4 (1.2-1.6) in bony interorbital space; protrusions on central margin of upper lip in the form of well-defined papillae.. .....*daedaleus boreus* (p. 111)

22b. Posterior nostril directly above anterior edge of eye; eye 1.1 (0.9-1.3) in bony interorbital space; protrusions on central margin of upper lip in the form of very shallow lobes..... .....*daedaleus brachysoma* (p. 109)

16b. Anus located close to anal fin origin; 1-3 very small papillae at center of upper lip between margin and premaxillary groove.

23a. Upper attachment of gill membrane opposite 9th pectoral ray; body depth 4.3-4.9 in standard length.

24a. Two very small papillae on center of upper lip between margin and premaxillary groove; no papillae on snout above center of premaxillary groove; papillae on head in form of well-defined lobes only, none of them long and finger-like.....*millerl* (p. 119)

24b. Three very small papillae on center of upper lip between margin and premaxillary groove; 4 very small papillae on snout above center of premaxillary groove; papillae on head extensively developed, some of them long and finger-like.....*crassicorpus* (p. 120)

23b. Upper attachment of gill membrane opposite 6th-8th pectoral ray; body depth 5.2-6.5 in standard length.

25a. Six-7 rows of flattened papillae across each part of disc region C; 1 large and 2 small papillae on ventral side of head behind rictus; head comparatively small, length 2.4-2.6 in standard length; 11-12 rows of flattened papillae across width of disc region A..... .....*multitentaculus* (p. 121)

25b. Four-5 rows of flattened papillae across each part of disc regi
C; 1 large and 3 small papillae on ventral side of head behind ri
tus; head comparatively large, length 2.3-2.4 in standard lengt
7-11 rows of flattened papillae across width of disc region A.
26a. In alcohol, the dorsal and lateral sides are a uniform light gr
color; eye 1.2-1.8 in bony interorbital space; depth of caud
peduncle 0.8-1.1 in its length; usually no minute papillae
snout above center of premaxillary groove.....
.....*papillifer papillifer* (p. 12
26b. In alcohol, the dorsal and lateral sides are a light brown colo
eye 1.1-1.2 in bony interorbital space; depth of caudal pedunc
1.1-1.2 in its length; 4 minute papillae on snout above center
premaxillary groove.....*papillifer microspilus* (p. 12

Gobiesox stenocephalus, new species

Figure 98

DIAGNOSIS: A *Gobiesox* with a poor development of papillae on head. Ma
gin of upper lip smooth. Dorsal origin much closer to caudal base than
upper pectoral base. Margin of anterior nostril with a very small, simpl
dermal flap. Anus much closer to rear margin of disc than to anal fin o
igin. Eye 0.7 in bony interorbital space and 3.8 (3.6-4.2) in head. Ea
part of disc region C composed of 3 longitudinal rows of papillae; 5 ro
across width of disc region A. Dorsal rays 9, anal rays 7 (6-7), pector
rays 21 (21-22), and caudal rays 12 (11-13).

DESCRIPTION: Body depressed, depth 5.6 (5.2-5.6) in standard lengt
Caudal peduncle short, least depth 1.1 (1.0-1.2) in its length.

Head well depressed, length 2.8 (2.7-2.8) and width 3.2 (3.0-3.5)
standard length. Snout shallow with a rounded outline, 3.4 (3.1-3.7)
head; posterior nostril directly above anterior edge of eye. Teeth
lower jaw in 2 rows, those of the outer row much the larger; the front 3
4 pairs compressed incisors, each with a single, shallow point, followed
each side by a row of canines. Teeth of upper jaw conical, irregular
position, the largest toward the front, forming a deep patch toward fro
of jaw. Specimens were too small to obtain an accurate gill-raker coun

All papillae on head shallow lobe-like structures, none on upper l
margin and none above center of premaxillary groove. Upper attachment
gill membrane opposite 3rd (3-4) pectoral ray. Subopercular spine well d
veloped and protrudes from skin of opercle region under pressure. Fles
pad on pectoral base conspicuous with a free posterior margin extendi
from upper gill-membrane attachment to lowest part of pectoral base. Upp
attachment of axial dermal flap opposite 7th (6-7) pectoral ray.

Dorsal-caudal distance forward extends to a point well behind upp
pectoral base; postdorsal-caudal distance 1.2 (1.0-1.4) in dorsal lengt
Length of disc 3.1 (3.0-3.2) in standard length. Depressed tip of anal f
does not extend nearly as far as a vertical line from caudal base.

COLORATION: In alcohol, the body has a very pale and transparent appea
ance. The dorsal and lateral sides are evenly covered with very smal
light-brown spots. The fins are all transparent with only a few of t
small pigment spots scattered at the base of the pectoral. The ventr
side of the body is very pale but has two noticeable rows of comparative
large, dark-brown spots located behind the disc and extending longitu
inally, one on each side of the anus.

RELATIONSHIP: This is an unusual and striking form in several respect
The individuals are very small and have a fragile appearance, without t
thick skin characteristic of most other known species of *Gobiesox*. T
eyes are very large, the head short and narrow, and the snout rather lon

T margin of the anterior nostril is provided with a small simple dermal f.p instead of the larger, bilobed structure characteristic of all other known species in the genus. *G. stenocephalus* has no known close relatives.

HOLOTYPE: Stanford University number 17408; 20.9 mm. in standard length. T.s specimen was taken by the Eastern Pacific *Zaca* (1937-38) Expedition o the New York Zoological Society at Puerto Parker, Costa Rica, on January 14, 1938.

PARATYPES: SU 17409; four specimens, from 17.7 mm. to 20.4 mm. in standard length, taken with the holotype.

DERIVATION OF NAME: The name is from the Greek *stenos*, narrow; and *kephale*, head.

Gobiesox potamius, new species

Figure 99

Gobiesox costaricensis (*non* Meek, 1912) Meek, 1914, p. 132 (Turrubares River, Costa Rica).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margin of upper lip smooth. Anus much closer to rear margin of disc than to anal fin origin. Teeth at front of upper jaw noticeably compressed. Eye 0.9 in bony interorbital space and 4.6 (4.4-4.7) in head. Each part of disc region C bears 5 (4-5) longitudinal rows of papillae; there are 6 (6-7) across width of disc region A. Fleshy pad on pectoral base conspicuous, with a free posterior margin extending dorsally from lowest part of pectoral base to a point opposite the 9th or 10th pectoral ray. Dorsal rays four 9, anal rays 7, pectoral rays 21, and caudal rays 11.

DESCRIPTION: Body well depressed, depth 6.1 or 6.2 in standard length. Caudal peduncle medium, depth 1.2 or 1.3 in its length. Head well depressed, length 2.5 or 2.6 and width 2.8 in standard length. Snout fairly steep with a slightly rounded outline, 3.2 or 3.3 in head. Posterior nostril non-tubular and located just in front of anterior edge of eye; anterior nostril tubular and provided with a large, bilobed, dermal flap extending from its posterior margin. Teeth of lower jaw in 1 row; the front 4 pairs compressed incisors with flat edges, followed on each side by a row of canines. Teeth at front of upper jaw noticeably compressed with rounded tips. Behind the outer row a deep patch of much smaller, conical teeth. A row of canines at each side of this jaw also. Eight shallow, pointed markers on the posteriormost gill arch.

All papillae on head shallow, lobe-like structures, none on upper lip margin and none on snout above center of premaxillary groove. Upper attachment of gill membrane opposite 2nd or 3rd pectoral ray. Subopercular spine well developed and protrudes from skin of opercle region under a slight pressure.

Dorsal-caudal distance forward extends to a point near distal end of pectoral fin; postdorsal-caudal distance 1.0 (0.8-1.1) in dorsal length. Length of disc 2.6 in standard length. Depressed tip of anal fin does not extend nearly as far as a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides a medium brown with darker brown spots scattered over the head. On the posterior part of the body behind the pectorals are three pale, vertical bars. There are very small, scattered, brown spots on the vertical and pectoral fins. The dorsal has a distinct, dark-brown spot at its anterior base. The caudal fin is dark at the base and tip but very pale in the center. The ventral surface of the body is translucent and almost colorless.

RELATIONSHIP: This form is most closely related to *G. juradoensis*, but differs in possessing fewer incisors in the lower jaw, a narrower head, and

a characteristic color pattern. Also front teeth of upper jaw are mo highly compressed than in any other known member of the genus, although n to the extent shown by front teeth of lower jaw.

HOLOTYPE: Chicago Natural History Museum number 7815; 35.0 mm. in sta dard length. This specimen was collected by Dr. Seth E. Meek from the R Turrubares, Pacific drainage, Costa Rica, on April 21, 1912.

PARATYPE: CNHM 7815; one specimen, 35.2 mm. in standard length, tak with the holotype.

DERIVATION OF NAME: The name is from the Greek *potamios*, of a rive in reference to its fresh-water habitat.

Gobiesox nudus (Linnaeus)

Cyclopterus nudus Linnaeus, 1754, p. 57, pl. 27, fig. 2; 1758, p. 2 (India, in error).

Gobiesox cephalus Lacépède, 1800, p. 595, fig. 1 (fresh-water rivers South America). —Brisout de Barneville, 1846a, p. 145 (Martinique —Günther, 1861, p. 499 and 566 (Caribbean Sea; St. Domingo; We Indies). —Jordan and Evermann, 1896, p. 491 (West Indies); 1898, 2332 (Caribbean Sea). —Jordan, Evermann, and Clark, 1930, p. 4 (West Indies). —Howell Rivero, 1936, p. 73 (Havana, Cuba). —Schult 1944, p. 74 (in part; West Indies; Costa Rica, but excluding Brazil

Lepadogaster testar Bloch and Schneider, 1801, p. 4 (no locality).

Cyclopterus bispinosus Shaw, 1804, vol. 5, pt. 2, p. 396 (India, in error

Gobiesox tudes Richardson, 1844, p. 103, pl. 46, figs. 1-3 (locality u known). —Jordan and Evermann, 1898, p. 2333 (West Indies). —Jorda Evermann, and Clark, 1930, p. 489 (probably West Indies).

Cotylis stanii Müller and Troschel 1849, p. 18, pl. 3, fig. 3 (Brazi probably in error).

Gobiesox costaricensis Meek, 1912, p. 74 (Zent River, Atlantic drainag Costa Rica). —Jordan, Evermann, and Clark, 1930, p. 489 (Costa Rica

Gobiesox ramsdeni Howell Rivero, 1936, p. 73 (Río Toa, Cuba).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Ma gin of upper lip smooth. Dorsal origin much closer to caudal base than upper pectoral base. Color of dorsal side light brown or blackish. An located well in front of dorsal origin and about midway between rear marg of disc and anal fin origin or closer to the former. Eye 1.6 (0.9-2.8) bony interorbital space and 6.9 (5.7-10.7) in head. Each part of dis region C bears 4 (4-5) longitudinal rows of papillae; there are 7 (6-8 rows across width of disc region A. Fleshy pad on pectoral base conspi uous with a free posterior margin extending from lowest part of pectora base dorsally as far as 8th (7-9) pectoral ray. Dorsal rays 9 (8-10), an rays 7 (6-8), pectoral rays 21 (19-22), and caudal rays 10 (10-11).

DESCRIPTION: Body well depressed, depth 6.2 (5.8-6.5) in standar length. Caudal peduncle short, least depth 1.1 (1.0-1.2) in its length Maximum known size about 150.0 mm. standard length.

Head well depressed and long, length 2.5 (2.2-2.6) and width 2.8 (2.3 3.1) in standard length. Snout fairly shallow with a slightly rounded ou line, 3.2 (3.1-3.4) in head. Posterior nostril in front of anterior ed of eye; anterior nostril with a comparatively small, bilobed, dermal fl extending from its posterior margin. Teeth of lower jaw in 1 row; front (5-7) pairs rounded incisors, followed on each side by a row of weak ca ines. Four (4-5) pairs of teeth at front of upper jaw rounded and incisor like. Behind outer row a deep patch of much smaller, conical teeth. Tee at sides of this jaw slightly recurved and canine-like. Seven shallo rakers on each of the two posterior gill arches.

All papillae on head shallow, lobe-like structures, none on upper lip rgin and none on snout above center of premaxillary groove. Upper at-chment of gill membrane occurs opposite 3rd (2-4) pectoral ray. Sub-ercular spine well developed but hidden by heavy skin of opercle region. per attachment of axial dermal flap opposite 5th (4-6) pectoral ray.

Dorsal-caudal distance forward extends not farther than distal one-third pectoral fin; postdorsal-caudal distance 1.3 (1.1-1.6) in dorsal length. ngth of disc 2.8 (2.6-3.1) in standard length. Depressed tip of anal fin es not extend as far as a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are a mottled brown blackish with no discernable pattern. The vertical fins are a lighter ade of the dorsal color except the tips are colorless. A distinct dark ot is found at the mid-anterior part of the dorsal fin. The pectorals e the same color as the vertical fins except that the tips are pigmented. e ventral surface is almost completely colorless and translucent.

RELATIONSHIP: There are several reasons why I consider *G. nudus* the most imitive member of its genus. First, and possibly most important, the eth of the lower jaw show the least specialization of all the species of *biesox*. The lower incisors are numerous, but very small, weakly com-essed, and not well differentiated from the bordering canines, which are so small and only slightly recurved. There is but one row of teeth in e lower jaw, a characteristic shared by only three other closely related ecies. The gill opening is comparatively large, the development of pa-llae on the head poor, the dorsal and anal fins short with few rays, the eshy pad on the pectoral base poorly developed, and the individuals grow an exceptionally large size.

The closest relatives of this form are the three species which inhabit esh-water streams tributary to the Pacific Ocean (*G. juradoensis*, *G. luus*, and *G. potamius*). A separation is most easily accomplished through ch characters as: relative size and specialization of teeth, position of us, eye size, and color.

MATERIAL EXAMINED: USNM 93816; one specimen from Macuto, Venezuela. MZ 146390; one, from Río Cerro Grande, near Macuto, Venezuela. CAS 363; four, from Cricamola River, Panama. USNM 93794; two, from Dominica, itish West Indies. MCZ 34152; one (holotype of *Gobiesox ramsdeni*), from e Río Toa, Cuba.

RANGE: Macuto near Caracas, Venezuela, to the Río Parismina, Costa Rica, d the West Indies. Fresh-water streams; Atlantic drainage.

REMARKS: The record of Müller and Troschel (*Cotylis stanii*) from Brazil evidently based on material from the Bloch collection in the Berlin Mu-um in which the locality data often have been found to be erroneous. azil is therefore not included in the range on the basis of this single cord.

The "original" description of *Cyclopterus nudus* Linnaeus is very brief d, as Schultz (1944, p. 63) has indicated, the species is not identifi-le on the basis of the information contained in the tenth edition of the *stema Naturae*. However, it may be noted that in this description Linnaeus fers to an earlier work of his entitled *Museum S. R. M. Adolphi Friderici ēis Suecorum*, etc., published in Stockholm in 1754. In this volume *C. dus* is given a more complete description and, most important, it is well lustrated by two figures. Therefore, it is possible to identify this ecies with that which was described later by Lacépède as *Gobiesox ceph-us*. It was interesting to find that this same work contained figures and scriptions of 88 other species of fishes, many of which were given a ch less detailed description (minus the illustrations) in Linnaeus' 1758 rk. It is suggested that the earlier publication may be used for a more sitive identification of many other Linnaean species.

Gobiesox juradoensis Fowler

Figure 100

Gobiesox juradoensis Fowler, 1944a, p. 247, fig. 24 and 25 (Río Jurado a 600 feet elevation); 1945b, p. 135 (Choco).—Briggs, 1951, p. 7 (Jurado River, Colombia).

Gobiesox rhyacophilus Briggs, 1951, p. 72, fig. 8 and 9 (Gorgona Island t Port Utria, Colombia).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margi of upper lip smooth. Dorsal origin much closer to caudal base than t upper pectoral base. Color of dorsal side a dark red-brown. Anus locate well in front of dorsal origin and usually closer to rear margin of dis than to anal fin origin. Eye usually 1.1 (0.7-1.2) in bony interorbita space and 5.0 (4.3-5.5) in head. Each part of disc region C bears 3 (2-3 longitudinal rows of papillae; there are 5 (5-6) rows across width of dis region A. Fleshy pad on pectoral base conspicuous, with a free posteric margin extending from lowest part of pectoral base dorsally as far as 9t (8-11) pectoral ray. Dorsal rays 9 (8-10), anal rays 7 (6-8), pectora rays 22 (20-22), and caudal rays 11 (10-12).

DESCRIPTION: Body moderately depressed, depth 5.1 (4.7-5.7) in standar length. Caudal peduncle short, least depth 1.0 (0.9-1.2) in its length Maximum known size 114.8 mm. standard length.

Head well depressed and long, length 2.3 (2.1-2.6) and width 2.6 (2.5 2.7) in standard length. Snout fairly shallow with a slightly rounded out line, 3.3 (2.9-3.5) in head. Posterior nostril above and usually just i front of anterior edge of eye; anterior nostril with a comparatively small bilobed, dermal flap extending from its posterior margin. Teeth of lowe jaw in 1 row; front 3 pairs pointed incisors in the smaller examples; fron 5 or 6 pairs rounded incisors in the larger individuals. These followed o each side by a row of canines. Teeth at front of upper jaw conical (may b only slightly compressed), the larger toward the front, irregular in po sition, forming a deep patch, followed on each side by teeth which ar slightly recurved and canine-like. Seven shallow rakers on each of th two posterior gill arches.

All papillae on head shallow, lobe-like structures, none on upper li margin and none on snout above center of premaxillary groove. Greates diameter of eye, in specimens 32.6 mm. to 63.7 mm. in standard length, 1. (0.7-1.2) in bony interorbital space and 5.0 (4.3-5.5) in head. In speci mens above 63.7 mm., the eye measured 1.5 (1.2-1.8) in bony interorbita space and 6.3 (5.3-7.3) in head. In specimens less than 32.6 mm., the ey in bony interorbital space measured 0.7 (0.7-0.8), and 4.3 (4.3-4.4) i head. Upper attachment of gill membrane occurs opposite 4th (3-6) pectora ray. Subopercular spine well developed but hidden under heavy skin o opercle region. Upper attachment of axial dermal flap opposite 6th (5-7 pectoral ray.

Dorsal-caudal distance forward extends not farther than distal one-hal of pectoral fin; postdorsal-caudal distance 1.3 (1.2-1.7) in dorsal length Length of disc 2.7 (2.6-2.9) in standard length. The depressed tip of ana fin usually does not extend beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are an even shad of dark red-brown. The median fins are a lighter shade of the same color The dorsal usually has a faint longitudinal white stripe and a conspicuou black spot at the middle anterior portion of the fin. The pectorals ar transparent except for scattered red-brown spots at the base and along eac ray. The ventral surface of the body is quite translucent with small

ttered, red-brown spots.

RELATIONSHIP: This species is very close to *G. fulvus* but can be separ- d because of its larger eyes, fewer papillae in disc region A, and, ally, a lesser development of the free posterior margin on the fleshy toral pad.

MATERIAL EXAMINED: HF 1191; one (holotype of *G. rhyacophilus*), from a sh-water stream which enters Watering Bay on Gorgona Island, Colombia. 16424; 19 (paratypes of *G. rhyacophilus*), taken at the same locality. 16425; one (paratype of *G. rhyacophilus*), from a fresh-water stream at t Utria, Colombia. SU 17395; one (paratype of *G. juradoensis*), from Río Jurado, Colombia.

RANGE: Gorgona Island to Jurado River, Colombia. Fresh-water streams; ific drainage.

REMARKS: *G. rhyacophilus* was originally described as new because of ked differences from the original description of *G. juradoensis* given Fowler in 1944. For example: the latter form was given such attributes pectoral rays 17, head 2 3/4 to 2 7/8 in standard length, and body depth /5 to 6 3/7 in standard length. In comparison the 21 specimens in the nford collection showed the following ranges for the same characters: toral rays 22 (20-22), head 2.3 (2.1-2.6) in standard length, and body th 5.1 (4.7-5.7) in standard length. Mr. Fowler kindly sent one of his atypes to Stanford on exchange. It was then possible to see that the species were identical, the specimens of *G. rhyacophilus* agreeing in respects with the paratype of *G. juradoensis*.

The Gorgona specimens were taken by Prof. Myers in 1938 with rotenone in small, swift stream up to an altitude of at least 100 feet. The only ier fishes in this stream were a catfish of the genus *Pygidium* and an *onostomus*. *Agonostomus* was seen but not captured.

Gobiesox fulvus Meek

iesox fulvus Meek, 1907, p. 149 (Cocos Island).—Schultz, 1944, p. 76 (Cocos Island).—Grey, 1947, p. 152, fig. 47 (Cocos Island).—Briggs, 1951, p. 75 (Cocos Island; fresh-water stream).
iesox poecilophthalmus (*non* Jenyns) Fowler, 1938, p. 260 (Cocos Island).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Mar- n of upper lip smooth. Dorsal origin much closer to caudal base than to per pectoral base. Color of dorsal side a dark red-brown. Anus usually cated closer to rear margin of disc than to anal fin origin. Eye usually 4 (1.3-1.4) in bony interorbital space and 6.2 (6.0-6.3) in head. Each rt of disc region C bears 3 (3-4) longitudinal rows of papillae; there e 7 (6-7) rows across width of disc region A. Fleshy pad on pectoral se conspicuous, with a free posterior margin usually extending from upper ll-membrane attachment to lowest part of pectoral base. Dorsal rays 9, al rays 7 (6-7), pectoral rays 22 (21-23), and caudal rays 12 (11-12).

DESCRIPTION: Body depressed, depth 5.2 (4.2-5.6) in standard length. udal peduncle short, least depth 1.0 (0.9-1.1) in its length. In a few the largest specimens abdomen becomes distended and anal opening pushed steriorly until it lies closer to anal fin origin than to rear margin of sc. Maximum known size 91.0 mm. standard length.

Head well depressed, length 2.3 (2.2-2.4) and width 2.7 (2.4-2.8) in andard length. Snout shallow with a slightly rounded outline, 3.1 (3.0- 3) in head. Posterior nostril just in front of anterior edge of eye; terior nostril provided with a small, bilobed, dermal flap extending from s posterior margin. Teeth of lower jaw in 1 row; at the front are 5 irs of small rounded incisors, followed on each side by a row of small

canines. Teeth at front of upper jaw conical, the largest toward th front, irregular in position, forming a fairly deep patch, followed on eac side by a row of slightly recurved canines. Eight shallow rakers on eac of the two posterior gill arches.

All papillae on head shallow, lobe-like structures, none on upper li margin and none above center of premaxillary groove. In specimens betwee 32.6 mm. and 63.7 mm., the greatest diameter of the eye measures 1.4 (1.3 1.4) in the bony interorbital space and 6.2 (6.0-6.3) in head; individual longer than 63.7 mm. measure 1.9 (1.8-2.0) in interorbital space and 6. (6.6-7.3) in head; those less than 32.6 mm. measure about 1.0 in interor bital space and 5.2 in head. Upper attachment of gill membrane opposit 3rd (2-5) pectoral ray. Subopercular spine well developed but hidden unde skin of opercle region. A few specimens were found in which the free post erior margin on the fleshy pectoral pad had a tendency to terminate in th vicinity of the 12th pectoral ray instead of continuing dorsally as far a the gill-membrane attachment. In all individuals the margin became les pronounced on the upper half of the pectoral base. Upper attachment o axial dermal flap opposite 6th (5-7) pectoral ray.

Dorsal-caudal distance forward extends only as far as distal half o pectoral fin; postdorsal-caudal distance 1.4 (1.2-1.6) in dorsal length Length of disc 2.8 (2.7-2.9) in standard length. Depressed tip of anal fi may extend as far as a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are an even shad of dark red-brown, sometimes with a few lighter reticulations. The vertica fins are a lighter shade of the same color. There is a conspicuous blac spot on the middle anterior portion of the dorsal fin. The pectorals ar a little lighter than the median fins. The ventral surface of the body i very pale with only scattered red-brown spots.

RELATIONSHIP: This species is very close to *G. juradoensis* but can b separated because of its smaller eyes, more papillae in disc region A, and usually, a greater development of the free posterior margin on the flesh pectoral pad.

MATERIAL EXAMINED: SU 16418; 13 specimens from the fresh-water strea tributary to Wafer Bay, Cocos Island, Eastern Tropical Pacific. ANS 52624-25; two, from Chatham Bay, Cocos Island. LACM (not numbered); one from Cocos Island.

RANGE: Cocos Island (fresh-water stream).

REMARKS: The Stanford specimens, together with a still larger lot in th Hancock Foundation, University of Southern California, were collected b Prof. Myers in February, 1938, with rotenone fish poison. They lived i the swiftest part of the current, where they adhered to the rounded stone with their sucking discs.

Gobiesox marmoratus Jenyns

Gobiesox marmoratus Jenyns, 1842, p. 140, pl. 27, figs. 1, 1a, 1b.—Gün ther, 1861, p. 504 (Chile).—Steindachner, 1898, p. 336 (Inique Tobon bajo, Tumbes, Cavancha-Bai, Juan Fernández).—Abbott, 1899, p 363 (Peru).—Delfin, 1901, p. 91 (Algarrobo, Chanaral, Punta Arenas Calbuco, Inique, Juan Fernández Island).—Thompson, 1916, p. 42 (Port Otway, Patagonia).—Pozzi and Bordale, 1935, p. 176 (52° 30 South Longitude, Argentina).—Tortonese, 1939, p. 206 (Valparaiso).

Sicyogaster marmoratus Brisout de Barneville, 1846a, p. 144 (Chile) —Schultz, 1944, p. 70 (Peru and Chile).

ylis marmoratus Müller and Troschel, 1849, p. 19 (Chile).
biesox nigricans Delfin, 1899, p. 122 (authorship attributed to Phillippi[1], Chonos Islands).—Fowler, 1944b, p. 525 (Chonos Islands).
ogaster marmorata Briggs, 1951, p. 92 (Punta Arenas, Chile, to Independencia Bay, Peru).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margin upper lip provided with wide, very shallow lobes. Dorsal origin much ser to upper pectoral base than to caudal base. Anus located closer to margin of disc than to anal fin origin. Eye 0.8 in bony interorbital e and 5.2 (4.9-5.4) in head. Each part of disc region C bears 3 (3-4) itudinal rows of papillae; there are 6 rows across width of disc region Fleshy pad on pectoral base conspicuous, with a free posterior margin ending dorsally from lowest part of pectoral base to a point opposite h (9-12) pectoral ray. Dorsal rays 13 (13-14), anal rays 10 (10-11), toral rays 22 (21-23), and caudal rays 10.

DESCRIPTION: Body depressed, depth 6.0 (5.8-6.2) in standard length. dal peduncle long, least depth 1.8 in its length. Maximum known size 0 mm. standard length.

Head well depressed, length 2.4 (2.3-2.4) and width 2.5 (2.4-2.5) in ndard length. Snout shallow with a flat outline, 3.2 (3.1-3.2) in head. terior nostril in front of anterior edge of eye; anterior nostril with arge, bilobed, dermal flap extending from its posterior margin. Teeth lower jaw in 2 rows, those of the inner row minute. The front 3 pairs outer row large, rounded incisors projecting sharply forward, followed each side by a row of canines. Teeth at front of upper jaw conical, egular in size and position, forming a deep patch, followed on each side a row of slightly recurved canines. Eight (8-9) shallow rakers on each the two posterior gill arches.

All papillae on head shallow lobe-like structures, sometimes discernable upper lip margin but none on snout above premaxillary groove. Upper achment of gill membrane opposite 4th (3-4) pectoral ray. Subopercular ne well developed, and protrudes from skin under pressure. Upper athment of axial dermal flap opposite 5th (4-6) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of upper toral base; postdorsal-caudal distance 1.9 (1.8-2.0) in dorsal length. gth of disc 2.7 (2.6-2.8) in standard length. Depressed tip of anal fin s not extend nearly as far as a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are covered with tches of dark-brown, irregularly placed, lending a marbled effect when wed from above. The vertical and pectoral fins are more or less evenly ered with small, dark-brown spots except that no pigment is present on tip of the caudal fin. The ventral surface of the body is much light- with relatively few scattered, dark-brown spots.

RELATIONSHIP: This species is most closely related to *G. maeandricus* and *eurgrammus*, but is readily separated from these two by the position of the s (closer to rear margin of disc than to anal fin origin) and the comatively few rows of papillae across width of disc region A. It is also

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cording to a communication from Mr. H. W. Fowler, the reference *Gosox nigricans* Phillippi appeared in Delfin's *Catálogo de los Peces de le* when it was first published in small sections in the journal *Revista l. Hist. Nat.* in 1898, 1899, and 1900. In 1901 the catalogue was prin- in its entirety but the reference to the above species was omitted. original description could not be located in any of Phillippi's better wn papers. Therefore, this form is tentatively placed in synonymy with hope that the description may someday be located.

the only relatively primitive *Gobiesox* which shows a tendency to devel shallow lobes on the upper lip margin.

MATERIAL EXAMINED: SU 37554; one specimen from San Juan Bay, Peru. S 37553; one, from Independencia Bay, Peru. USNM 101706; one, from Indepe dencia Bay, Peru. BM 1917.7.14.71-2; two (syntypes of *Gobiesox marmoratus* from Chile. ?USNM 88821; one, from Juan Fernández Island.

RANGE: 52° 30' S. longitude in Santa Cruz, Argentina, through th Strait of Magellan and north to Independencia Bay, Peru.

REMARKS: The specimen listed above from Juan Fernández Island is onl doubtfully identified as this species. The individual is very small a could not be properly compared with the much larger mainland specimens.

Gobiesox eugrammus, new species

Figure 101

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Marg of upper lip smooth. Dorsal origin much closer to upper pectoral base th to rear margin of disc. Eye 0.9 (0.8-1.0) in bony interorbital space a 4.3 (4.0-4.7) in head. Each part of disc region C bears 3 longitudina rows of papillae; there are 8 (7-8) rows across width of disc region A Fleshy pad on pectoral base conspicuous, with a free posterior margin ex tending dorsally from lowest part of pectoral base to a point opposite 8 (6-10) pectoral ray. Dorsal rays 14 (14-15). anal rays 12 (11-13), pec toral rays 24 (23-26), and caudal rays 10 (9-11).

DESCRIPTION: Body only slightly depressed, depth 5.1 (4.4-5.5) in sta dard length. Caudal peduncle short, least depth 1.2 (0.9-1.3) in it length. Anus located under 2nd (1-4) dorsal ray and much closer to ana fin origin than to rear margin of disc.

Head well depressed, length 2.4 (2.3-2.6) and width 2.5 (2.4-2.6) i standard length. Snout shallow with a slightly rounded outline 3.0 (2.8 3.2) in head. Posterior nostril directly above anterior edge of eye; ant rior nostril with a large, bilobed dermal flap extending from its posteri margin. Teeth of lower jaw in 2 rows, those of the outer row much th larger; the front 4 (3-4) pairs usually rounded or pointed incisors. Th pointed incisors of smaller individuals seem to be replaced by heavier i cisors in larger specimens. These larger teeth may be rounded or possess very shallow trifid structure. Replacement takes place from front of ja a condition noted in other members of this genus. Teeth of upper jaw co ical, irregular in position, the larger toward the front, forming a de patch toward front of jaw. Specimens were too small to obtain an accura gill-raker count.

All papillae on head shallow, lobe-like structures, none on upper l margin and none on snout above center of premaxillary groove. Upper a tachment of gill membrane opposite 3rd (2-4) pectoral ray. Subopercul spine well developed but hidden under skin of opercle region. Upper a tachment of axial dermal flap opposite 9th (8-10) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of upp pectoral base; postdorsal-caudal distance 2 5 (2.0-3.0) in dorsal lengt Length of disc 3.0 (2.7-3.4) in standard length. Depressed tip of anal f usually extends to or slightly beyond a vertical line from caudal base.

COLORATION: In alcohol, the body surfaces are all a very pale and tran lucent gray with only a few pigment spots in the form of small, dark-bro dots scattered over the dorsal surface and on the vertical fins. Sever such dots can also be seen at the base of the pectoral fin.

RELATIONSHIP: The individuals are very small and have a fragile appea ance, apparently lacking the thick skin which is characteristic of most the other known species of *Gobiesox*. It is most closely related to

dricus but can be separated by such characters as eye size, position osterior nostril, number of pectoral rays, and coloration. This is the l fairly deep-water clingfish so far known from the Eastern Pacific. It uite likely that it will eventually be taken at localities other than alupe Island.

OLOTYPE: Stanford University number 17402; 19.9 mm. in standard length. specimen was collected by Dr. Carl L. Hubbs and party from the re-ch vessel *E. W. Scripps* at Guadalupe Island, Baja Calif., Mexico, on mber 8, 1946. It was taken by a dredge from a depth of 40-45 fathoms.

ARATYPES: SU 17403; one specimen, 14.4 mm. in standard length, dredged elpomene Cove, Guadalupe Island, on December 8, 1946. SU 17404; two imens, 17.2 mm. and 12.7 mm. in standard length, dredged at the same lity on December 11, 1946. SIO (not numbered); 11 specimens, ranging 11.8 mm. to 20.6 mm. in standard length, dredged at the south end of alupe Island on February 2, 1950. All paratypes were taken by Dr. Carl ubbs and party aboard the *E. W. Scripps*.

ERIVATION OF NAME: From the Greek *eu*, well or very; and *gramma*, a let-mark, or picture.

Gobiesox maeandricus (Girard)

Figure 2

dogaster reticulatus Girard, 1854, p. 155 (San Luis Obispo, Calif.) (preoccupied).

dogaster maeandricus Girard, 1858, p. 130 (San Luis Obispo, "S. Faralones", Calif.) (new name).

esox maeandricus Günther, 1861, p. 505 (Monterey, California).

archus reticulatus Gill, 1861, p. 330.

esox reticulatus Jordan and Jouy, 1881, p. 5 (Monterey and Cape Flattery).—Jordan and Gilbert, 1881, p. 63 (Monterey to Puget Sound).—Rosa Smith, 1881, p. 140, 141 (San Diego).—Guitel, 1889, pl. 29 (anatomy).

archus maeandricus Jordan and Evermann, 1896, p. 491 (Vancouver Island to Monterey); 1898, p. 2328 (Vancouver Island to Point Conception).—Evermann and Goldsborough, 1907, p. 336 (Fort Rupert; Gabriola Island).—Jordan, Evermann, and Clark, 1930, p. 488 (Vancouver Island to Monterey).—Schultz, 1936, p. 197 (British Columbia to Point Arguello, Calif).—Wilby, 1936, p. 116 (British Columbia).

vogaster maeandricus Schultz, 1944, p. 70 (Queen Charlotte Islands to San Diego, Calif.; Puget Sound).

togaster maeandrica Briggs, 1951, p. 94 (San Diego, Calif. to Puget Sound, Washington, and the Queen Charlotte Islands).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margin front of upper lip smooth. Dorsal origin much closer to upper pectoral than to caudal base. Anus usually located closer to anal fin origin to rear margin of disc. Eye 1.4 (1.2-1.9) in bony interorbital space 6.7 (5.5-8.3) in head. Each part of disc region C bears 3 (3-4) longudinal rows of papillae; there are 8 (7-9) rows across width of disc ion A. Fleshy pad on pectoral base conspicuous, with a free posterior gin extending dorsally from lowest part of pectoral base to a point osite 9th (7-10) pectoral ray. Dorsal rays 16 (14-16), anal rays 14 -15), pectoral rays 22 (21-23), and caudal rays 12 (11-13).

DESCRIPTION: Body depressed, depth 5.3 (4.8-6.0) in standard length. dal peduncle medium, least depth 1.3 (1.0-1.4) in its length. Anus ally located in front of dorsal origin but may lie under first 1 or 2 sal rays. Maximum known size 114.0 mm. standard length.

Head well depressed, length 2.5 (2.3-2.6) and width 2.7 (2.4-2.9) standard length. Snout shallow with a flat outline, 3.2 (3.0-3.3) in he Posterior nostril just in front of anterior edge of eye; anterior nost with a large, bilobed, dermal flap extending from its posterior marg Teeth of lower jaw mainly in 2 rows, those of inner row well developed not as large as those of the outer. The front 4 (3-4) pairs of the ou row are large rounded incisors, projecting sharply forward. The 4 pairs juvenile incisors are replaced from the front by 3 pairs of larger in sors. Later an additional pair of these larger teeth is added, 1 on e side, giving a total of 4 pairs for the largest adults. These incis followed on each side by a row of canines. Teeth at front of upper conical, irregular in size and position, forming a deep patch, followed each side by a row of slightly recurved canines. Eight shallow rakers each of the two posterior gill arches.

All papillae on head shallow, lobe-like structures, none on upper and none on snout above center of premaxillary groove. Upper attachment gill membrane opposite 4th (3-5) pectoral ray. Subopercular spine w developed but hidden under skin of opercle region. Upper attachment axial dermal flap opposite 7th (6-8) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of up pectoral base; postdorsal-caudal distance 2.6 (2.2-2.9) in dorsal leng Length of disc 2.9 (2.7-3.0) in standard length. Depressed tip of anal extends close to or beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral surfaces are laced w a network of black or dark-brown lines. In some individuals, many of th lines are run together giving a rather blotched instead of a netwo effect. Small brown or black dots are fairly evenly distributed on t vertical fins except for the tips of the rays, which are unpigmented translucent. The pectorals are lightly scattered with these small spot The ventral surface of the body is much lighter with comparatively f pigment spots.

RELATIONSHIP: This species is a primitive marine *Gobiesox*. It is cl to *G. eugrammus* and *G. marmoratus*, but is separated by its smaller eyes longer anal fin. Its range extends much farther north than any other m ber of the genus.

MATERIAL EXAMINED: CAS 6835; one specimen from San Diego, Californi SU 3390; 3400; 5961; 15212; 22290; 23622; 24675; 31696; 31993; 3222 35113; 35125; 35126; 35416; and 38064; a large series, ranging from Arro de la Cruz, San Luis Obispo County, California, north to Puget Soun Washington, and the San Juan Islands.

RANGE: San Diego, California, to Puget Sound, Washington, and the Qu Charlotte Islands, British Columbia.

REMARKS: The presence of a specimen from San Diego in the Californ Academy of Sciences collection substantiates the record of Rosa Smith (18 p. 140), and indicates that this species probably does range as far so as San Diego. There is, however, no twentieth century record of specim taken south of Point Arguello.

Gobiesox rhessodon Rosa Smith

Gobiesox rhessodon Rosa Smith, *in* Jordan and Gilbert, 1881, p. 63 (Po Loma; *nomen nudum*). —Rosa Smith, 1881, p. 140 (San Diego, Calif. —Briggs, 1951, p. 66 (in part; Malibu, California, to San Bartolo Baja California; excluding *Gobiesox sapoensis* Fowler from synonymy

Arbaciosa rhessodon Jordan, 1896, p. 230, pl. 36 (San Diego). —Jordan Evermann, 1896, p. 492 (San Diego; Gulf of California); 1898;

2340 (San Diego; Gulf of California).—Fowler, 1923, p. 294 (Malibu, Venice, San Pedro, Catalina Harbor, Isthmus Harbor).—Jordan, Evermann, and Clark, 1930, p. 490 (San Diego, Gulf of California).—Barnhart, 1936, p. 93 (Lower California to San Pedro).
itridens rhessodon Schultz, 1944, p. 58 (Southern California to Baja California).

IAGNOSIS: A *Gobiesox* with poorly developed papillae on head and none argin of upper lip. Dorsal origin closer to upper pectoral base than audal base. Lower incisors with a distinct trifid structure in speci- of all sizes. Anus closer to anal fin origin than to rear margin of . Eye 1.3 (1.2-1.4) in bony interorbital space and 6.1 (5.4-6.7) in . Each part of disc region C comparatively short, and bears 2 (1-3) itudinal rows of papillae; there are 6 (6-7) rows across width of disc on A. Dorsal rays 13 (12-14), anal rays 11 (11-12), pectoral rays 19 21), and caudal rays 11 (11-12).

ESCRIPTION: Body depressed, depth 6.0 (5.4-6.7) in standard length. al peduncle medium, least depth 1.3 (1.1-1.4) in its length. Anus usu- located slightly in front of dorsal origin. Maximum known size 39.3 standard length.

ead well depressed, length 2.5 (2.3-2.6) and width 2.8 (2.7-3.0) in dard length. Snout shallow with a slightly rounded outline, 3.2 (3.0- in head. Posterior nostril directly over anterior edge of eye; ante- nostril provided with medium-sized, biloped, dermal flap extending from posterior margin. Teeth of lower jaw in 2 rows, those of the outer much the larger; the front 5 (5-6) pairs compressed incisors with a inct trifid structure, followed on each side by a row of canines in h 1 pair is usually highly developed. Teeth at front of upper jaw ly conical and irregular in size and position; a few may be slightly ressed. One to 3 strong canines following the conical teeth on each of upper jaw. Seven shallow rakers on each of the two posterior gill es.

hallow lobe-like papillae present on lower jaw only; none on margin of r lip and none on snout above center of premaxillary groove. Upper at- ment of gill membrane opposite 5th pectoral ray. Subopercular spine developed but hidden under skin of opercle region. Fleshy pad on oral base conspicuous with a free posterior margin extending from upper -membrane attachment to lowest part of pectoral base. Upper attachment xial dermal flap opposite 8th (7-9) pectoral ray.

orsal-caudal distance forward extends well in front of upper pectoral ; postdorsal-caudal distance 2.5 (2.3-2.7) in dorsal length. Length of 3.3 (3.0-3.4) in standard length. Depressed tip of anal fin may ex- to or slightly beyond a vertical line from caudal base.

OLORATION: In alcohol, the dorsal and lateral sides are thickly covered small, close-set, dark-brown, pigment spots. The vertical and pec- l fins, as well as their connecting membranes, are covered with these s. There is no characteristic color pattern apparent for this species. posterior half of the ventral body surface is lighter but still well red with small brown spots. The ventral surface of the disc and head only a few such spots and are quite translucent.

ELATIONSHIP: This form may be distinguished by its prominent trifid r incisors and the well-developed canines at sides of upper jaw. Also, region C is the most poorly developed in the genus, sometimes with 3 or 4 flattened papillae in each of the 2 parts.

ATERIAL EXAMINED: SU 16423 and 2474; four specimens from San Bartolomé Baja Calif., Mexico. SU 16422; three, from Turtle Bay, Baja Calif., co. CAS 19419; two, from between Río Santo Tomás and Punta Santa s, Baja Calif., Mexico. CAS 19624; one, from 2 miles south of Río

Socorro mouth, Baja Calif., Mexico. CAS 12469; 19496; and 19528; 20, f
Bird Rock near La Jolla, California. CAS 20439; four, from Sunset Cliff
San Diego, California. USNM 28396; three (syntype of *Gobiesox rhessodon*
from San Diego, California. SU 9929; 21, from La Jolla, California.

RANGE: San Bartolomé Bay, Baja Calif., Mexico, to Malibu, just north
Los Angeles, California.

Gobiesox nigripinnis (Peters)

Cotylis nigripinnis Peters, 1860, p. 412 (Puerto Cabello, Venezuela).
Gobiesox nigripinnis Günther, 1861, p. 502 (Puerto Cabello).—Jordan a
Evermann, 1896, p. 491 (same locality); 1898, p. 2331 (same loca
ity); 1898, p. 2331 (same locality).—Metzelaar, 1922, p. 140 (Ca
casbay).—Jordan, Evermann, and Clark, 1930, p. 488 (Puerto Cabello
?*Gobiesox nudus* (*non* Linnaeus) Metzelaar, 1919, p. 151 (Curaçao and Bo
aire).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Marg
of upper lip smooth. Dorsal origin much closer to upper pectoral base th
to caudal base. Each lobe of bilobed dermal flap extending from margin
anterior nostril branches into several points. Anus located much closer
posterior margin of disc than to anal fin origin. Eye 1.0 (0.9-1.0)
bony interorbital space and 5.1 (5.0-5.3) in head. Each part of disc r
gion C bears 1 or 2 longitudinal rows of papillae; there are 6 rows acro
width of disc region A. Dorsal rays 13 (13-14), anal rays 8 (7-8), pe
toral rays 24 (23-25), and caudal rays 11.

DESCRIPTION: Body depressed, depth 6.3 (6.0-6.6) in standard lengt
Caudal peduncle short, least depth 1.1 in its length. Anus located und
dorsal origin. Maximum known size about 60.0 mm. standard length.

Head well depressed, length 2.3 and width 2.5 (2.5-2.6) in standa
length. Snout shallow with a slightly rounded outline, 3.1 (2.9-3.2)
head; posterior nostril directly above anterior edge of eye. Teeth
lower jaw in 2 rows, those of outer row much the larger; the front 4 or
pairs compressed incisors with pointed tips, followed on each side by a r
of canines. Teeth at front of upper jaw conical, irregular in size a
position, forming a deep patch, followed on each side by a row of slight
recurved canines. Specimens were too small for an accurate gill-rak
count.

All papillae on head shallow, lobe-like structures, none on upper l
margin and none on snout above center of premaxillary groove. Upper a
tachment of gill membrane opposite 7th (6-7) pectoral ray. Subopercul
spine well developed but hidden under skin of opercle region. Fleshy p
on pectoral base conspicuous, with a free posterior margin extending fr
upper gill-membrane attachment to lowest part of pectoral base. Upper a
tachment of axial dermal flap opposite 6th (5-7) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of upp
pectoral base; postdorsal-caudal distance 2.6 (2.4-2.8) in dorsal lengt
Length of disc 2.9 (2.8-3.1) in standard length. Depressed tip of anal f
extends to a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are more or le
evenly covered with small, close-set, light-brown spots. The vertical fi
are covered with the same type of pigment spots, and a dark-brown spot
apparent on the anterior base of the dorsal fin. The ventral surface
the body is much lighter with only scattered light-brown spots.

RELATIONSHIP: This species is not very closely related to any oth
Gobiesox. The peculiar branched condition of the dermal flaps of the ant
rior nostrils is found only on this species. It is probably closer to

tulatus than to any of the other forms, in spite of the fact that there numerous differences between these two.

MATERIAL EXAMINED: SU 3250; two specimens from Curaçao Island, Nether- ds West Indies. AM (not numbered); one, from Caracasbay on Curaçao and.

RANGE: Puerto Cabello, Venezuela, to Curaçao Island, Netherlands West ies.

REMARKS: The identity of *Cotylis nigripinnis* Peters was somewhat diffi- t to establish because of the extreme brevity of the original descrip- n. However, there are only three known Western Atlantic species which ld be concerned. These are *Gobiesox strumosus* Cope (*C. n. nigripinnis* Schultz), *G. punctulatus* (Poey), and the species described above. Pe- s states, "Nostrils, mouth, teeth, opercular spine, and fin rays as in *ylis stannii* [*G. nudus*], but dorsal fin longer." The mouth of *G. umosus* is considerably different from that of *G. nudus* (*G. stannii*) ce well-defined papillae are present on upper lip margin and on front lower jaw, instead of a smooth upper lip margin and only shallow lobes lower jaw. Furthermore, the anal ray count (6) given by Peters seems small for Cope's species (usually 9 or 10) even if the first 2 small s were missed.

Gobiesox punctulatus and *G. nigripinnis* both have a mouth similar to *G. us* and a shorter anal fin. *G. punctulatus*, as far as is known, has only o 21 pectoral rays, while Peters lists 22 for *nigripinnis*. In addition, is virtually certain that *G. punctulatus* is the same fish as *Cotylis* a Müller and Troschel (see page 108). It hardly seems possible that ers would describe as new a species already described by Müller and schel, since their material was available to him at the Berlin Museum. refore, it seems most probable that Peters had the species here consi- ed. The pectoral rays in *nigripinnis* are known to vary from 23 to 25, the pectoral counts of the older authors were frequently low for this us, since the first ray is often poorly developed.

The specimens examined were taken very close to the type locality.

Gobiesox schultzi Briggs

Figure 102

iesox schultzi Briggs, 1951, p. 67, figs. 3 and 4 (San Marcos Island, Baja Calif., Mexico, to San Carlos Bay, Sonora, Mexico).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margin upper lip smooth. Dorsal origin much closer to upper pectoral base than caudal base. Anus located closer to anal fin origin than to rear margin disc and under 8th (6-9) dorsal ray. Eye 1.1 (1.0-1.3) in bony inter- ital space and 5.4 (5.0-6.1) in head. Each part of disc region C bears 2-3) longitudinal rows of papillae; there are 5 (5-6) rows across width disc region A. Dorsal rays 19 (18-20), anal rays 10 (9-11), pectoral s 20 (19-22), and caudal rays 10.

DESCRIPTION: Body moderately depressed, depth 5.4 (4.8-6.1) in standard gth. Caudal peduncle short, least depth 1.0 (0.8-1.2) in its length. imum known size 54.9 mm. standard length.

Head well depressed, length 2.4 (2.3-2.6) and width 2.6 (2.5-2.7) in ndard length. Snout shallow with a flat or slightly rounded outline, (3.2-3.4) in head. Posterior nostril directly above anterior edge of ; anterior nostril with a medium, bilobed, dermal flap extending from posterior margin. Teeth of lower jaw in 2 rows, those of the outer row h the larger; the front 4 (4-5) pairs of incisors rounded in the larger cimens, very shallow trifid in the smaller. These incisors followed on

each side by a row of canines. Teeth at front of upper jaw conical, th larger toward the front, irregular in position, forming a deep patch followed on each side by a row of slightly recurved canines. Eight or shallow rakers on each of the two posterior gill arches.

All papillae on head shallow, lobe-like structures; none on upper li margin and none on snout above center of premaxillary groove. Upper at tachment of gill membrane opposite 6th (6-7) pectoral ray. Subopercula spine fairly well developed but hidden under skin of opercle region. Flesh pad on pectoral base conspicuous, with a free posterior margin extendin from upper gill-membrane attachment to lowest part of pectoral base. Uppe attachment of axial dermal flap opposite 6th (4-6) pectoral ray.

Dorsal-caudal distance forward extends to anterior part of snout o beyond its end; postdorsal-caudal distance 5.5 (4.7-6.0) in dorsal length Length of disc 3.0 (2.8-3.1) in standard length. Depressed tip of anal fi extends far past a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are an even shad of medium gray, with small black spots scattered over the anterior portio of the body. The dorsal, anal, and caudal fins are gray except that th tips of the rays are lighter. The pectoral is colorless except for smal dark spots along each ray. The ventral surface of the body is a very ligh gray, and a few pigment spots are present on the surface of the disc.

RELATIONSHIP: This species is distinctive because of its gray color long dorsal fin, and smooth upper lip margin. The dorsal fin is similar length to that of *G. pinniger*, but there are other points of differenc (besides color and nature of the upper lip margin). For example: *G. schultzi* has fewer papillae across disc region A, a smaller eye; anu closer to anal fin origin, and usually fewer rays in pectoral fin.

MATERIAL EXAMINED: SU 17407; five specimens from Ceralbo Island, Baj Calif., Mexico. SU 36561; eight (paratypes of *G. schultzi*), from Sa Marcos Island, Baja Calif., Mexico. UCLA field number W52-4; 446, fro Guaymas, Sonora, Mexico. SU 16426-16427; four (holotype and three para types of *G. schultzi*), from San Carlos Bay, north of Guaymas, Sonora, Mex ico. HF 1462; one from Turners Island, just south of Tiburón Island, Son ora, Mexico.

RANGE: Gulf of California, from Ceralbo Island, Baja Calif., Mexico, t Turners Island, just south of Tiburón Island, Sonora, Mexico.

Gobiesox punctulatus (Poey)

Lepadogaster nudus (*non* Linnaeus) Bloch and Schneider, 1801, p. 2 (India mistaken locality?).

Cotylis nuda (*non* Linnaeus) Müller and Troschel, 1849, p. 18, pl. 3, fig 2 (Indies: locality from Bloch and Schneider).

Gobiesox nudus (*non* Linnaeus) Günther, 1861, p. 502 (West Indies).

Sicyases punctulatus Poey, 1875, p. 124 (Cuba).—Jordan, Evermann, an Clark, 1930, p. 490 (Cuba).

Gobiesox haeres Jordan and Bollman, 1889, p. 552 (Green Turtle Cay, Baham as).—Jordan and Evermann, 1896, p. 492 (same locality); 1898, p 2337 (same locality).

Gobiesox vittatus Metzelaar, 1922, p. 140, fig. 3 (Caracasbay).

Gobiesox gyrinus Jordan and Evermann, 1896, p. 491 (*nomen nudum*; preoccu pied by *G. gyrinus* Valenciennes *in* Cuvier 1836, pl. 108, fig. 1) 1898, p. 2331 (based on *Gobiesox nudus* (*non* Linnaeus) Günther).

Sicyases haeres Jordan, Evermann, and Clark, 1930, p. 490 (Green Turtl Cay, Bahamas).

Gobiesox punctulatus Schultz, 1944, p. 76 (Bahama Islands and West Indies Texas and British Honduras).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margin f upper lip smooth. Dorsal origin much closer to upper pectoral base than caudal base. Disc length 2.6 (2.5-2.7) in standard length. Anus usu- y located about halfway between posterior margin of disc and anal fin gin but may be slightly closer to one or the other. Eye 1.2 (1.0-1.4) bony interorbital space (1.2-1.4 in the larger specimens) and 5.8 (5.2-) in head. Each part of disc region C bears 2 (1-3) longitudinal rows papillae; there are 6 (5-7) rows across width of disc region A. Dorsal s 11 (11-12), anal rays 8 (7-9), pectoral rays 21 (19-22), and caudal s 11 (10-11).

DESCRIPTION: Body depressed, depth 5.2 (4.5-5.7) in standard length. dal peduncle short, least depth 1.0 (0.8-1.2) in its length. Anus usu- y under base of 2nd (1-4) dorsal ray. Maximum known size 45.2 mm. stan- d length.

Head well depressed, length 2.3 (2.2-2.4) and width 2.5 (2.4-2.7) in ndard length. Snout shallow with a flat outline, 3.2 (2.8-3.6) in head. terior nostril above or just in front of anterior edge of eye; anterior tril provided with a large, bilobed dermal flap extending from its post- or margin. Teeth of lower jaw in 2 rows, those of the outer row much larger; the front 5 (4-6) pairs are narrow, usually pointed, incisors, lowed on each side by a row of canines. Teeth at front of upper jaw ical, the largest toward the front, irregular in position, forming a p patch, followed on each side by a row of slightly recurved canine th. Six or 7 shallow rakers on each of the two posterior gill arches.

All papillae on head shallow, lobe-like structures, none on upper lip gin and none on snout above center of premaxillary groove. Upper at- hment of gill membrane opposite 6th (5-7) pectoral ray. Subopercular ne well developed but hidden under skin of opercle region. Fleshy pad pectoral base conspicuous, with a free posterior margin extending from er gill-membrane attachment to lowest part of pectoral base. Upper at- hment of axial dermal flap opposite 5th (4-6) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of upper toral base; postdorsal-caudal distance 2.2 (2.0-2.7) in dorsal length. pressed tip of anal fin extends to or slightly beyond a vertical line m caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are more or less nly covered with a background of small, close-set light-brown spots. In lition, there are conspicuous, comparatively large, dark-brown spots ttered over the dorsal surface of the head and on the light-colored iris the eye. The vertical and pectoral fins are well covered with the small kground spots. The middle anterior part of the dorsal fin is sometimes iceably darker than the rest of the fin. The ventral surface of the y is much lighter with only scattered light-brown spots.

RELATIONSHIP: Most specimens of this species are immediately noticeable ause of the conspicuous dark-brown spots which are scattered over the sal side of the head. The comparatively small eyes and the narrow in- sors in the lower jaw are also characters which serve to separate this m from its relatives.

MATERIAL EXAMINED: AM (not numbered); one (holotype of *G. vittatus*), and ee others, from Caracasbay, Curaçao Island, Netherlands West Indies. SU 300; one specimen from Mosquito Point, Ustup Island, San Blas, Panama. Z 30758; two, from Swan Islands, Caribbean Sea. USNM 37531; two, from ba. MU 872; three, from Rabbit Key, Bimini, Bahamas. MU 869; six, from ton Cay, Anguila Island, Cay Sal Bank, Bahamas. ANSP (not numbered); ee, from Treasure Island, Salt Cay, Bahamas.

RANGE: San Blas, Panama, to Texas; and Curaçao Island to the Bahama lands.

REMARKS: It seems certain that *Lepadogaster nudus* Bloch and Schneider

and *Cotylis nuda* Müller and Troschel are the same species, since Müller an Troschel (1849, p. 18) state that their material was from the Bloch col lection in the Berlin Museum. In their description, Müller and Trosche list sufficient characters so that their fish may be identified with littl hesitation. There are only three known species which could possibly b considered as identical with the *C. nuda* of these authors. They ar *Gobiesox punctulatus* (Poey), *G. nigripinnis* (Peters), and *G. strumosus* Cop (*Cotylis nigripinnis nigripinnis* of Schultz). The latter species can b easily eliminated because it possesses distinct barbels or papillae aroun the mouth, and the dorsal fin is not nearly twice as long as the ana (Müller and Troschel state that there are no barbels on the gape and tha the dorsal fin is twice as long as the anal). In deciding between th other two forms, it seems quite clear that *G. punctulatus* is the specie concerned, since it has noticeably smaller eyes than *G. nigripinnis*, fewe rays in the pectoral fin, and the correct color pattern (Müller and Tros chel state that the eyes are very small, there are 18 rays in the pectora fin, and the color is brownish with darker dispersed flecks). While 1 pectoral rays is one less than 19, the minimum so far known for *G. punctu latus*, it is considerably less than the 23 to 25 range so far recorded fo *G. nigripinnis*. Pectoral ray counts of the genus *Gobiesox* are frequentl too low because the first ray is usually so reduced that it is ofte missed.

The description of *Gobiesox nudus* by Günther (1861, p. 502) further sub stantiates the fact that Poey's species is the one concerned. He mention the very narrow incisors in the lower jaw (which is most applicable to *G punctulatus*) and the brownish color with scattered dark spots. He als gives a pectoral ray count of 20 instead of 18. In regard to the locality he gives this information: "There can be no doubt that the specimens i the British Museum are specifically identical with those in the Berli Museum, and it is equally certain that the former were collected in th West Indies."

Gobiesox daedaleus daedaleus Briggs

Figure 103

Gobiesox daedaleus Briggs, 1951, p. 63, figs. 1 and 2 (Gorgona Island Colombia).

DIAGNOSIS: A *Gobiesox* with poor development of papillae on head. Margi of upper lip smooth. Dorsal origin usually closer to caudal base than t upper pectoral base, or equidistant between the two. Head width 2.9 (2.7 3.1) in standard length. Anus located approximately midway between post erior margin of disc and anal fin origin. Eye 1.0 (0.9-1.1) in bony inter orbital space and 5.0 (4.3-5.4) in head. Each part of disc region C bear 2 (2-3) longitudinal rows of papillae; there are 4 (4-5) rows across widt of disc region A. Dorsal rays 12, anal rays 8, pectoral rays 22 (21-23) and caudal rays 11 (10-12).

DESCRIPTION: Body depressed, depth 6.4 (5.7-7.1) in standard length Caudal peduncle short, least depth 0.9 (0.7-1.0) in its length. Anus lo cated in front of dorsal origin. Maximum known size 34.0 mm. standar length.

Head well depressed, length 2.6 (2.4-2.7) in standard length. Snou shallow with a slightly rounded outline, 3.1 (2.8-3.5) in head. Posterio nostril directly above anterior edge of eye; anterior nostril provided wit a large, bilobed dermal flap extending from its posterior margin. Teeth c lower jaw in 2 rows, those of the outer row much the larger; the front pairs compressed incisors, each with a single, shallow point in the large

imens, very shallow trifid in the smaller. These incisors followed on
side by a row of comparatively large canines. Teeth of upper jaw con-
, irregular in size and position, forming a deep patch, followed on
side by a row of slightly recurved canines. Six (5-6) shallow rakers
ach of the two posterior gill arches.

ll papillae on head shallow, lobe-like structures, none on upper lip
gin and none on snout above center of premaxillary groove. Upper at-
ment of gill membrane opposite 7th (6-8) pectoral ray. Subopercular
e well developed but hidden under skin of opercle region. Fleshy pad
ectoral base conspicuous, with a free posterior margin extending from
r gill-membrane attachment to lowest part of pectoral base. Upper at-
ment of axial dermal flap opposite 8th (6-9) pectoral ray.

Dorsal-caudal distance forward usually extends to upper pectoral base or
behind this structure; postdorsal-caudal distance 2.3 (2.0-2.6) in
al length. Length of disc 3.2 (3.1-3.3) in standard length. Depressed
of anal fin extends to or slightly beyond a vertical line from caudal
e.

COLORATION: In alcohol, the dorsal and lateral sides are more or less
ly covered with small, close-set, light-brown pigment spots. Wide
tical bars of a slightly darker brown can be seen faintly on the post-
or half of the body. The vertical fins, including the membranes con-
ting the individual rays, are all light brown but the tips are trans-
ent. In addition, the dorsal fin has a distinct brown spot at its ante-
r base. In the pectoral fins only the rays are spotted with light
wn, the connecting membranes remaining transparent. The ventral surface
the body is lighter with scattered light-brown spots. A few of these
ts may also be found on the disc surface and on the ventral side of the
d.

RELATIONSHIP: This form is most easily separated from its nearest rela-
e, *G. d. brachysoma*, by the smooth, rather than (usually) a lobed, upper
margin. Also, the head is narrower, there are fewer papillae in disc
ion C, and the eye is slightly larger. Eventually, intergrades will
bably be found somewhere in the area between Gorgona Island and the
ama Bay region.

MATERIAL EXAMINED: HF 1190; one specimen (the holotype of *G. daedaleus*),
m a pool behind the beach at Watering Bay, Gorgona Island, Colombia.
17401; nine, also from Gorgona Island.

RANGE: Gorgona Island, Colombia.

REMARKS: The three subspecies of *G. daedaleus* form an interesting group.
ceeding northward from the Gorgona Island population to that of the Pan-
Bay area, and, finally, to that from the Gulf of Fonseca, progressive
nges are to be observed as follows: the upper lip margin develops from
mooth state (*G. d. daedaleus*), to one usually with shallow lobes (*G. d.
chysoma*), and, farthest north, to one where relatively well-developed
illae are present (*G. d. boreus*). In a like manner, the eye size de-
eases, the head width increases, the papillae across disc region A become
ller and more numerous, the dorsal origin moves forward, and the number
anal rays shows a tendency to increase.

Gobiesox daedaleus brachysoma (Briggs)

tylis brachysoma Briggs, 1951, p. 83, figs. 11 and 12 (Braxilito Bay,
Costa Rica).

DIAGNOSIS: A *Gobiesox* with moderate development of papillae on head.
rgin of upper lip usually with shallow lobes. Dorsal origin closer to
per pectoral base than to caudal base, or equidistant between the two.

Anus usually located just in front of dorsal origin. Snout 3.0 (2.7-3.2 in head. Eye 1.1 (0.9-1.3) in bony interorbital space and 5.5 (5.0-6.0) head. Each part of disc region C bears 2 (1-3) longitudinal rows of papillae; there are 6 (6-7) rows across width of disc region A. Dorsal rays (12-13), anal rays 8 (8-9), pectoral rays 22 (22-24), and caudal rays (10-12).

DESCRIPTION: Body depressed, depth 6.1 (5.0-6.8) in standard length Caudal peduncle short, least depth 0.9 (0.8-1.2) in its length. Anus located under 1st or 2nd dorsal ray, and about midway between rear margin of disc and anal fin origin. Maximum known size 58.8 mm. standard length.

Head well depressed, length 2.5 (2.3-2.6) and width 2.6 (2.4-2.7) in standard length. Snout shallow with a slightly rounded outline. Posterior nostril directly above anterior edge of eye; anterior nostril provided with a large, bilobed dermal flap extending from its posterior margin. Teeth of lower jaw in 2 rows, those of the outer row much the larger; the front pairs compressed incisors, each with a single shallow point. These incisors followed on each side by a row of comparatively large canines. Teeth at front of upper jaw conical, irregular in size and position, forming a deep patch, followed on each side by a row of slightly recurved canines. Six (6-7) shallow rakers on each of the two posterior gill arches.

All papillae on head are lobe-like structures, also present on upper lip margin, but none on snout above center of premaxillary groove. Upper attachment of gill membrane opposite 7th (6-8) pectoral ray. Subopercular spine well developed but hidden under skin of opercle region. Fleshy pad on pectoral base conspicuous, with a free posterior margin extending from upper gill-membrane attachment to lowest part of pectoral base. Upper attachment of axial dermal flap opposite 7th (6-8) pectoral ray.

Dorsal-caudal distance forward extends to upper pectoral base or a little in front of this structure; postdorsal-caudal distance 2.6 (2.3-2.9 in dorsal length. Length of disc 2.8 (2.7-3.0) in standard length. Depressed tip of anal fin extends a little beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are more or less covered with small, close-set, light-brown pigment spots. Wide vertical bars of a slightly lighter color can sometimes be seen on the posterior half on the body. The vertical fins and their connecting membranes are also light brown. In addition, the dorsal fin has a distinct brown spot at its anterior base. In the pectoral fins, only the rays are spotted with light brown, the connecting membranes remaining transparent. The ventral surface of the body is lighter, with scattered, light-brown spots. A few of these spots may also be found on the disc surface, and on the ventral side of the head.

RELATIONSHIP: This subspecies can be separated from the other members of its genus by the characters listed in the key. It was interesting to note that, while most specimens possessed distinct shallow lobes on the central upper lip margin, in others this margin was almost completely smooth. In other species, the presence or absence of such lobes or papillae is a reliable and important diagnostic character. Both types of individuals (lobed and unlobed) may be correctly identified by means of the key. As far as is known, all of the individuals belonging to the subspecies to the south (*G. d. daedaleus*) have a smooth central margin on the upper lip while those of the northern subspecies (*G. d. boreus*) show distinct, well-formed lobes.

MATERIAL EXAMINED: SU 17380-17381; six specimens from the Pearl Islands, Panama Bay, Panama. KZM 5.10.1928.78; one, also from one of the Pearl Islands. SU 17391; one, from Bahia Honda, Panama. SU 17390; one from Ballenas Bay, Gulf of Nicoya, Costa Rica. CAS 20440-20441; four (holotype plus three paratypes), from Braxilito Bay, Costa Rica. SU 17388-17389; four, from Piedra Blanca Bay, Costa Rica. SU 17385-17387; four

r1 Puerto Parker, Costa Rica. SU 17382-17384; 14, from San Juan del u Nicaragua.

ANGE: From the Pearl Islands, Panama Bay, Panama, to San Juan del Sur, i ragua.

Gobiesox daedaleus boreus, new subspecies

Figure 104

DIAGNOSIS: A *Gobiesox* with moderate development of papillae on head. gin of upper lip has distinct lobes. Dorsal origin closer to upper pec- al base than to caudal base. Anus usually located just in front of dor- origin. Snout 3.0 (2.9-3.2) in head. Posterior nostril just in front anterior edge of eye. Eye 1.4 (1.2-1.6) in bony interorbital space and (5.3-7.2) in head. Each part of disc region C bears 3 (2-4) longitud- l rows of papillae; there are 7 (6-8) rows across width of disc region Dorsal rays 12 (11-12), anal rays 9 (8-10), pectoral rays 22 (21-23), caudal rays 10 (10-11).

DESCRIPTION: Body depressed, depth 5.2 (4.8-6.9) in standard length. dal peduncle short, least depth 1.1 (0.9-1.2) in its length. Anus about way between rear margin of disc and anal fin origin.

Head well depressed, length 2.5 (2.4-2.7) and width 2.5 (2.4-2.6) in ndard length. Snout shallow with a slightly rounded outline; anterior tril with a large, bilobed dermal flap extending from its posterior mar- . Teeth of lower jaw in 2 rows, those of the outer row much the larger; front 3 (3-5) pairs compressed incisors, each rounded or with a shallow nt in the larger specimens, and very shallow trifid in the smaller. se incisors followed on each side by a row of comparatively large can- s. Teeth at front of upper jaw conical, irregular in size and position, ming a deep patch, followed on each side by a row of slightly recurved ines. Six shallow rakers on each of the two posterior gill arches.

All papillae on head lobe-like, present on upper lip, but none above ter of premaxillary groove. Upper attachment of gill membrane opposite (6-7) pectoral ray. Subopercular spine well developed but hidden under n of opercle region. Fleshy pad on pectoral base conspicuous, with a e posterior margin extending from upper gill membrane to lowest part of toral base. Upper attachment of axial dermal flap opposite 7th (6-8) toral ray.

Dorsal-caudal distance forward extends to a point in front of the upper toral base; postdorsal-caudal distance 2.3 (2.1-2.4) in dorsal length. gth of disc 2.8 (2.6-3.0) in standard length. Depressed tip of anal fin s not extend beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides as well as the rays the vertical fins and their connecting membranes are all more or less nly covered with small, close-set, light-brown pigment spots. The dor- l fin usually has a distinct brown spot at its anterior base. In the toral fins only the rays are spotted with light-brown, the connecting mbranes remaining transparent. The ventral surface of the body is light- with scattered, light-brown spots. A few of these spots may also be nd on the disc surface, and on the ventral side of the head.

RELATIONSHIP: This form is well separated from the other members of the up by the characters in the key. At present, it seems most likely at it is a subspecies, and will grade into *G. d. brachysoma* a short dis- nce to the south.

HOLOTYPE: Stanford University number 17392; 40.4 mm. in standard length. is specimen was taken by the Eastern Pacific *Zaca* (1937-38) Expedition of e New York Zoological Society at Conchaguita Island, Gulf of Fonseca, El lvador, on December 22, 1937.

PARATYPES: SU 17393; 12 specimens, from 25.3 to 43.2 mm. in standar length, taken with the holotype at Conchaguita Island. SU 17394; 25 speci mens, from 19.9 mm. to 43.7 mm. in standard length, also taken by the *Zac* (1937-38) Expedition at Punta Chiquiria, Gulf of Fonseca, El Salvador, o December 21, 1937.

DERIVATION OF NAME: The name is from the Greek, *boreius*, northern.

Gobiesox pinniger Gilbert

Gobiesox pinniger Gilbert, 1890a, p. 94 (Puerto Refugio, Ángel Island San Luis Gonzáles Bay, and La Paz, Gulf of California).—Pellegrin 1901a, p. 162 (Gulf of California).

Bryssetaeres pinniger Jordan and Evermann, *in* Jordan, 1896, p. 230, pl. 34 1896, p. 491 (Gulf of California); 1898, p. 2328 (Gulf of California) —Jordan, Evermann, and Clark, 1930, p. 488 (Gulf of California) —Breder, 1936, p. 48 (Puerto Refugio; Gonzago Bay).

Cotylis pinniger Schultz, 1944, p. 69 (Gulf of California).—Briggs, 1951 p. 88 (La Paz to Punta Peñasco, Mexico).

DIAGNOSIS: A *Gobiesox* with well-developed lobe-like papillae on head an along margin of upper lip. Dorsal origin much closer to upper pectora base than to caudal base. Anus located midway between posterior margin o disc and anal fin origin or slightly closer to the latter. Eye 0.9 (0.8 1.0) in bony interorbital space and 5.3 (4.7-5.6) in head. Each part o disc region C bears 3 (2-4) longitudinal rows of papillae; there are 7 (6 8) rows across width of disc region A. Dorsal rays 18 (16-19), anal ray 10 (10-11), pectoral rays 23 (22-23), and caudal rays 12 (11-12).

DESCRIPTION: Body depressed, depth 6.4 (5.5-7.4) in standard length Caudal peduncle short, least depth 1.1 (1.0-1.2) in its length. Anus lo cated under 7th (6-7) dorsal ray. Maximum known size 71.2 mm. standar length.

Head well depressed, length 2.5 (2.3-2.6) and width 2.7 (2.6-2.8) i standard length. Snout shallow with a slightly rounded outline, 3.2 (3.1 3.4) in head. Posterior nostril directly above anterior edge of eye; ante rior nostril with a dermal flap divided into 2 narrow lobes. Teeth o lower jaw in 2 rows, those of the outer row much the larger; the front (4-5) pairs compressed incisors, rounded in the larger specimens, shallo trifid in the smaller. These incisors followed on each side by a row o comparatively large canines. Teeth at front of upper jaw conical, irreg ular in size and position, forming a deep patch, followed on each side by row of slightly recurved canines. Seven or 8 shallow rakers on each o the two posterior gill arches.

Head with distinct, lobe-like papillae, also present on margin of uppe lip; none on snout above center of premaxillary groove. Upper attachmen of gill membrane opposite 7th (6-8) pectoral ray. Subopercular spine wel developed but hidden under skin of opercle region. Fleshy pad on pectora base conspicuous, with a free posterior margin extending from upper gill membrane attachment to lowest part of pectoral base. Upper attachment o axial dermal flap opposite 6th (5-7) pectoral ray.

Dorsal-caudal distance forward reaches well beyond front of snout; pos dorsal-caudal distance 5.2 (4.2-6.1) in dorsal length. Length of disc 3 (3.0-3.2) in standard length. Depressed tip of anal fin usually extend well beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are covered with background of small, close-set, black pigment spots. This is usually inte rupted by five or six light vertical bars of irregular shape lying post erior to the pectoral. In addition, there is a noticeable dark streak whi

ases horizontally through the eye, and a second dark streak extending
ically from the lower border of the eye to the margin of the head. The
ical fins and the pectorals are well supplied with small black spots,
the tips of the rays are colorless and transparent. The ventral sur-
e of the body is considerably lighter with only scattered black spots.

RELATIONSHIP: A distinctive species easily identified by the long dorsal
i vertical bars on posterior part of body, and papillae on upper lip
gin. Dorsal fin similar in length to that of *G. schultzi* but there are
er points of difference (besides color and state of upper lip margin).
c example: *G. pinniger* has more papillae across disc region A; a larger
y anus not as close to anal fin origin, and usually more rays in pec-
al fin.

MATERIAL EXAMINED: SU 44; 24 specimens (syntypes of *G. pinniger*), from
aPaz, Baja Calif., Mexico. HF 1463; one, from Puerto San Carlos, Sonora,
eico. SU 16414; 31, from San Carlos Bay, Sonora, Mexico. SU 17405;
n, from Santa Inez Islands, Baja Calif., Mexico. SU 17406; 20, from
rto Libertad, Sonora, Mexico. SU 39930; 16400-16411; 59, from Punta
asco, Sonora, Mexico.

RANGE: Gulf of California, from La Paz, Baja Calif., Mexico, to Punta
asco, Sonora, Mexico.

Gobiesox aethus (Briggs)

Figure 105

ylis aethus Briggs, 1951, p. 91, figs. 17 and 18 (Clarión Island, Revilla Gigedo Group).

DIAGNOSIS: A *Gobiesox* with well-developed, lobe-like papillae on head
along margin of upper lip. Dorsal origin much closer to caudal base
n to upper pectoral base. Body highly depressed, depth 7.3 in standard
gth. Eye 1.0 in bony interorbital space and 4.5 in head. Papillae in
h part of disc region C not counted (this part poorly preserved); 10
s of papillae across width of disc region A. Dorsal rays 10, anal rays
pectoral rays 23, and caudal rays 10.

DESCRIPTION: Caudal peduncle fairly short, least depth 1.2 in its
gth. Anus located in front of dorsal fin origin and slightly closer to
l fin origin than to rear margin of disc. Maximum known size 28.8 mm.
standard length.

Head depressed, length 2.6 and width 2.6 in standard length. Snout
llow with a flat outline, 2.9 in head. Posterior nostril directly above
erior edge of eye; anterior nostril with a large, bilobed dermal flap
ending from its posterior margin. Each lobe comparatively wide and
nded at the end. Teeth of lower jaw in 2 rows, those of outer row much
larger; the front 4 pairs large incisors distinctly trifid. These in-
iors followed on each side by a row of canines. Teeth at front of upper
conical, the larger toward the front, irregular in position, forming
eep patch, followed on each side by a row of slightly recurved canines.
otype not dissected for gill-raker count.

Well-developed, lobe-like papillae on head and along margin of upper
; none on snout above center of premaxillary groove. Upper attachment
gill membrane opposite 6th pectoral ray. Subopercular spine well deve-
ed but hidden by skin of opercle region. Fleshy pad on pectoral base
spicuous, with a free posterior margin extending from upper gill-mem-
ne attachment to lowest part of pectoral base. Upper attachment of
al dermal flap opposite 6th pectoral ray.

Dorsal-caudal distance forward comes to about distal one-third of pec-
al fin; postdorsal-caudal distance 1.7 in dorsal length. Length of disc

2.9 in standard length. Depressed tip of anal fin just reaches a vertica line from caudal base.

COLORATION: In alcohol, the dorsal and lateral surfaces are very ligh and covered with many very small red-brown dots. The rays of all of th fins are also provided with these minute dots of pigment. The entire ven tral surface is colorless and translucent. A wide vertical stripe, no ticeably darker than the rest of the body, lies across the base of the cau dal fin.

RELATIONSHIP: Trifid lower incisors, a highly depressed body, and a mor posterior origin of dorsal fin are the most noticeable characters separ ating this island form from the known mainland species. It is close to *G canidens* but can be distinguished by the several items listed in the key.

MATERIAL EXAMINED: SU 5898; one specimen (the holotype), from Clarió Island, Revilla Gigedo Archipelago.

RANGE: Clarión Island, Revilla Gigedo Archipelago, tropical Easter Pacific.

Gobiesox canidens (Briggs)

Cotylis canidens Briggs, 1951, p. 88. figs. 15 and 16 (Socorro Island, Revilla Gigedo Group).

DIAGNOSIS: A *Gobiesox* with well-developed lobe-like papillae on head an along margin of upper lip. Dorsal origin much closer to caudal base tha to upper pectoral base. Incisors in lower jaw comparatively large and dis tinctly trifid. Body highly depressed, depth 8.1 (7.6-8.6) in standar length. Eye 1.0 (0.9-1.0) in bony interorbital space and 4.3 (4.1-4.7) i head. Each part of disc region C bears 4 or 5 longitudinal rows of pa pillae; there are 9 or 10 rows across width of disc region A. Dorsal ray 11 (10-11), anal rays 8 (8-9), pectoral rays 22 (21-22), and caudal ray 10.

DESCRIPTION: Caudal peduncle fairly short, least depth 1.2 (1.0-1.3) i its length. Anus located in front of dorsal fin origin, and midway be tween rear margin of disc and anal fin origin, or slightly closer to ana fin origin. Maximum known size 39.2 mm. standard length.

Head depressed, length 2.7 and width 2.6 in standard length. Snou shallow with a slightly rounded outline, 3.2 (3.1-3.3) in head. Posterio nostril directly above anterior edge of eye; anterior nostril with a large biloped, dermal flap extending from its posterior margin. Each lobe com paratively wide and pointed at the end. Teeth of lower jaw in 2 rows those of outer row much the larger; the front 4 pairs large incisors, dis tinctly trifid. These incisors followed on each side by a row of canine. with the 2nd and/or 3rd pairs large and well developed. Teeth at front o upper jaw conical, the larger toward front, irregular in position, formin a deep patch, followed on each side by a row of slightly recurved canines Single paratype in collection not dissected for gill-raker count.

Well-developed, lobe-like papillae on head and along margin of uppe lip; none on snout above center of premaxillary groove. Upper attachmen of gill membrane occurs opposite 6th (5-6) pectoral ray. Subopercula spine fairly well developed but hidden by skin covering opercle region Fleshy pad on pectoral base conspicuous, with a free posterior margin ex tending from upper gill-membrane attachment to lowest part of pectora base. Upper attachment of axial dermal flap opposite 6th (6-7) pectora ray.

Dorsal-caudal distance forward extends to about middle of pectoral fin postdorsal-caudal distance 2.4 (2.0-3.0) in dorsal length. Length of dis 3.1 (3.1-3.2) in standard length. Depressed tip of anal fin reaches

htly past a vertical line from caudal base.

OLORATION: In alcohol, the dorsal and lateral sides are a uniform, dark kish brown. The dorsal, anal, and caudal fins are the same shade, pt that the distal edges are colorless. The dorsal fin has a distinct k spot at the anterior edge, and the pectorals are mostly transparent n small brown spots along each ray. The ventral surface of the body is orless and translucent.

ELATIONSHIP: This isolated island species is outstanding in several re-ts. Its highly depressed body, very dark color, and trifid lower in-ors bordered by large canines are the characters which serve to distin-sh it from the mainland forms. It is close to *G. aethus*, but the sev-. characters given in the key seem to separate it reliably.

ATERIAL EXAMINED: CAS 20442; 2135; 1655; three specimens (the holo-e and two paratypes), from Socorro Island, Revilla Gigedo Archipelago. U16416; one (paratype), from the same locality. UCLA field number W53-9 12, from Brinner's Cove, Socorro Island.

ANGE: Socorro Island, Revilla Gigedo Archipelago, tropical Eastern ific.

REMARKS: The largest of the UCLA specimens, an individual 34.0 mm. ndard length, showed four *rounded* replacement teeth growing in front of trifid incisors in the lower jaw. This suggests that still larger cimens might have rounded instead of trifid incisors.

Gobiesox strumosus Cope

Cotylis fimbriata Müller and Troschel, 1849, p. 18 (Red Sea; Indian Ocean[1]).

Gobiesox strumosus Cope, 1870, p. 121 (Hilton Head, South Carolina). —Jordan and Evermann, 1896, p. 491 (Carolina to Florida); 1898, p. 2333, (Hilton Head, South Carolina; Indian River and Titusville, Florida).

Gobiesox virgatulus Goode and Bean, 1882, p. 236 (Gulf of Mexico; *nomen nudum*). —Jordan and Gilbert, 1882b, p. 293 (Pensacola, Florida). —Jordan and Evermann, 1896, p. 491 (Pensacola Bay, Florida, to Charleston, South Carolina); 1898, p. 2333 (same localities). —Jordan, Evermann, and Clark, 1930, p. 489 (same localities).

Gobiesox barbatulus Starks, 1913, p. 73, pl. 14 (Natal, Brazil).

Gobiesox yuma Nichols, 1917, p. 876, fig. 1 (Sanibel Light, west coast of Florida). —Breder, 1927, p. 85 (Royal Islands, Bahamas). —Jordan, Evermann, and Clark, 1930, p. 490 (Florida).

Gobiesox sancti-martini Metzelaar, 1919, p. 151, fig. 48 (St. Martin and Simsonsbay Lagoon, Dutch West Indies). —Jordan, Evermann, and Clark, 1930, p. 490 (West Indies).

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[1] The identity of *Cotylis fimbriata* of Müller and Troschel has presented rather perplexing problem. The locality for this species is given as the Sea and Indian Ocean, and the collectors are listed as Hemprich and henberg, who traveled extensively in the North African and East Asian a. However, from the characters given in the original description, it ms clear that this species is a member of the subfamily Gobiesocinae, a up almost entirely confined to the New World, and unknown from tropical ers outside of the Americas. Furthermore, the specific description fits her well that of *Gobiesox strumosus*, the common widespread Western At-tic form.

In recent years a good deal of collecting effort has been expended on Red Sea, yet, so far as is known, no clingfishes have been taken. On other hand, Hemprich and Ehrenberg evidently made no travels or col-tions in the New World. In view of this confusing situation, *Cotylis briata* is only tentatively identified with Cope's species.

Cotylis nigripinnis nigripinnis (*non* Peters) Schultz, 1944, p. 65, pl. 1 (Chesapeake Bay to Brazil; West Indies).—Fowler, 1949, p. 4 (Ne Jersey).—Kanazawa, 1952, p. 95 (Bermuda).

DIAGNOSIS: A *Gobiesox* with well-developed lobe-like papillae on head an along margin of upper lip. Dorsal origin closer to upper pectoral bas than to caudal base. Body depth 5.4 (4.7-6.3) in standard length. Anu located much closer to anal fin origin than to rear margin of disc. Ey 1.4 (1.2-1.8) in bony interorbital space and 6.2 (5.2-7.7) in head. Eac part of disc region C bears 4 (3-5) longitudinal rows of papillae; ther are 8 (7-10) rows across width of disc region A. Dorsal rays 12 (10-13) anal rays 10 (9-11), pectoral rays 24 (22-26), and caudal rays 12 (11-13).

DESCRIPTION: Body depressed; caudal peduncle short, least depth 1. (0.8-1.1) in its length. Anus located under 3rd (1-5) dorsal ray. Maxi mum known size 69.3 mm. standard length.

Head well depressed, length 2.5 (2.3-2.6) and width 2.6 (2.4-2.7) i standard length. Snout shallow with a slightly rounded outline, 2.9 (2.7 3.1) in head. Posterior nostril directly above anterior edge of eye; ante rior nostril with a large, bilobed dermal flap extending from its posterio margin. Teeth of lower jaw in 2 rows, those of the outer row much th larger; the front 4 (3-5) pairs compressed incisors rounded at the tips i the larger specimens, and very shallow trifid in the smaller. These inci sors followed on each side by a row of prominent canines. Teeth at fron of upper jaw conical, irregular in size and position, forming a deep patch followed on each side by a row of slightly recurved canines. Six (6-7 shallow rakers on each of the two posterior gill arches.

Well-developed lobe-like papillae on head and along margin of upper lip none on snout above center of premaxillary groove. Upper attachment o gill membrane opposite 7th (7-8) pectoral ray. Subopercular spine wel developed, but hidden under skin of opercle region. Fleshy pad on pectora base conspicuous, with a free posterior margin extending from upper gill membrane attachment to lowest part of pectoral base. Upper attachment o axial dermal flap opposite 7th (6-9) pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of uppe pectoral base; postdorsal-caudal distance 2.3 (2.0-2.6) in dorsal length Length of disc 2.8 (2.5-2.9) in standard length. Depressed tip of anal fi extends to or beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are usually ligh brown, often with a series of dark-brown, longitudinal streaks. The colo of the vertical fins varies from dark brown or black to a very light-brow color, lighter than that of the body. Sometimes a distinct dark spot i apparent on the anteriormost portion of both the dorsal and anal fins. Th pectorals are usually lighter than the vertical fins. The ventral surfac is very pale, with only a few scattered light-brown spots.

RELATIONSHIP: This species stands out mainly due to the well-develope papillae on head and upper lip margin, the relative proximity of anus t anal fin origin, and the 24 (22-26) pectoral rays. Its closest relative are found in the tropical Eastern Pacific.

MATERIAL EXAMINED: MN (not numbered); three specimens from Santos, São Paulo, Brazil. SU 17415; one, from Onchieta, Espirito Santo, Brazil SU 22210; one (holotype of *G. barbatulus*), from Natal, Rio Grande do Norte Brazil. SU 22521; three (paratypes of *G. barbatulus*), also from Natal AM (not numbered); one (holotype of *G. sancti-martini*), from St. Martin Netherlands West Indies. SU 40532; four, from Galveston Bay, Texas. S 21376; two, from Cameron, Louisiana. SU 17412-17414; nine, from vicinit of Barataria Bay, Louisiana. KZM 20.9.1846; one, from New Orleans, Louisi ana. SU 441; one (holotype of *G. virgatulus*), from Pensacola, Florida SU 1669; one (a paratype of *G. virgatulus*), also from Pensacola. SU 3639

from Punta Rassa, Lee County, Florida. SU 36390-36391; 36393-36394; from Sanibel Island, Lee County, Florida. AMNH 5737; one (holotype of *esox yuma*), from Sanibel Light, Florida. SU 17410; one (syntype of *G. umosus*), from Hilton Head, South Carolina. SU 3299; one, from Charles- South Carolina. USNM 91212; five, from Rappahannock River, Virginia. M 48586; two, from Bermuda.

RANGE: From Santos, São Paulo, Brazil, to New Jersey, including the West ies, Gulf of Mexico, and Bermuda.

Gobiesox woodsi (Schultz)

ylis nigripinnis woodsi Schultz, 1944, p. 68 (Cocos Island at Wafer Bay).—Grey, 1947, p. 136, fig. 38 (Cocos Island: Wafer Bay).
ylis woodsi Briggs, 1951, p. 83 (Cocos Island).

DIAGNOSIS: A *Gobiesox* with well-developed lobe-like papillae on head and ng margin of upper lip. Dorsal origin equidistant between caudal base upper pectoral base. Anus located just in front of dorsal fin origin. ut 3.8 in head. Median fins black. Eye 1.0 in bony interorbital space 5.0 in head. Papillae of disc region C could not be counted (due to dition of specimen); 9 rows of papillae across width of disc region A. sal rays, 12, anal rays 10, pectoral rays 21, and caudal rays 12.

DESCRIPTION: Body depressed, depth 7.3 in standard length. Caudal pedle short, least depth 1.1 in its length. Anus slightly closer to rear gin of disc than to anal fin origin. Maximum known size 33.0 mm. standd length.

Head well depressed, length 2.6 and width 2.4 in standard length. Snout llow with a slightly rounded outline. Posterior nostril directly above erior edge of eye; anterior nostril with a large, bilobed, dermal flap ending from its posterior margin. Teeth of lower jaw in 2 rows, those the outer row much the larger; the front 3 pairs compressed incisors. th of upper jaw conical, the larger toward the front. Holotype not dsted for gill-raker count.

Well-developed lobe-like papillae on head and along margin of upper lip. e on snout above center of premaxillary groove. Upper attachment of l membrane opposite 5th pectoral ray. Subopercular spine well-developed hidden under skin of opercle region. Fleshy pad on pectoral base with ree posterior margin extending from upper gill-membrane attachment to est part of pectoral base. Upper attachment of axial dermal flap opite 6th pectoral ray.

Dorsal-caudal distance forward extends to upper edge of pectoral base; tdorsal-caudal distance 2.6 in dorsal length. Length of disc 3.2 in ndard length. Depressed tip of anal fin reaches a little past a verti line from caudal base.

COLORATION: In alcohol, body is pale brownish. There are five wide, istinct bars on body, the paler interspaces narrower than eye. Sides of y with several very pale, narrow lines. A dark, elongate spot behind and a few narrow, pale lines radiating posteriorly from the orbit oss the gill cover. Median fins black with tips of rays white.

RELATIONSHIP: Can be distinguished through use of the several characters ted in key. Also, the black median fins with white tips on the rays uld help to separate individuals of this species.

MATERIAL EXAMINED: None. Many of the detailed counts and measurements ted above were taken by Dr. Loren P. Woods from the holotype in the Chio Natural History Museum.

RANGE: Cocos Island, tropical Eastern Pacific.

Gobiesox adustus Jordan and Gilbert

Figure 106

Gobiesox adustus Jordan and Gilbert, 1882a, p. 360 (Mazatlán); 1883, p. 627 (Central America).—Jordan and Evermann, 1896, p. 491 (Mazatlán); 1898, p. 2334 (Mazatlán; Pacific coast of Mexico).—Pellegrin, 1901b, p. 206 (Río Chapalagana and Río Grande de Santiago).—Osburn and Nichols, 1916, p. 177 (San Francisquito Bay, Baja Calif., Mexico).—Jordan, Evermann, and Clark, 1930, p. 489 (Pacific coast of Mexico).—Schultz, 1944, p. 77 (Mazatlán, Mexico).—Fowler, 1944b, p. 525 (Port Utria, Colombia).—Briggs, 1951, p. 65 (Río Grande de Santiago, Sinaloa, Mexico, to San Francisquito Bay, Baja Calif., Mexico).

Gobiesox sapoensis Fowler, 1944b, p. 235, fig. 257 (Playa Muerto, Panama).

Cotylis saxatilis Briggs, 1951, p. 84, figs. 13 and 14 (Port Utria, Colombia, and Cape San Francisco, Ecuador).

DIAGNOSIS: A *Gobiesox* with well-developed lobe-like papillae on head and along margin of upper lip. Point of dorsal origin variable, usually a little closer to caudal base than to upper pectoral base. Anus located well in front of dorsal fin origin. Snout 2.9 (2.7-3.2) in head. Eye 1.0 (0.8-1.2) in bony interorbital space and 4.9 (4.2-5.7) in head. Each part of disc region C bears 5 (4-7) longitudinal rows of papillae; there are 8 (7-10) rows across width of disc region A. Dorsal rays 11, anal rays 9 (9-10), usually 9, pectoral rays 23 (21-24), and caudal rays 11 (10-12).

DESCRIPTION: Body depressed, depth 6.5 (5.7-7.5) in standard length. Caudal peduncle short, least depth 1.1 (0.8-1.3) in its length. Anus about midway between rear margin of disc and anal fin origin. Maximum known size 46.7 mm. standard length.

Head well depressed, length 2.5 (2.3-2.6) and width 2.6 (2.4-2.7) in standard length. Snout shallow with a slightly rounded outline. Posterior nostril directly above anterior edge of eye; anterior nostril with a large bilobed, dermal flap extending from its posterior margin. Teeth of lower jaw in 2 rows, those of the outer row much the larger; the front 3 or 4 pairs compressed incisors, rounded in the larger specimens, and shallowly trifid in the smaller. These incisors followed on each side by a row of comparatively large canines. Teeth at front of upper jaw conical, irregular in size and position, forming a deep patch, followed on each side by a row of slightly recurved canines. Seven (6-7) shallow rakers on each of the two posterior gill arches.

Head with distinct, lobe-like papillae, which are also on margin of upper lip; none on snout above center of premaxillary groove. Upper attachment of gill membrane opposite 7th (6-8) pectoral ray. Subopercular spine well developed, but hidden under skin of opercle region. Fleshy pad on pectoral base conspicuous, with a free posterior margin extending from upper gill-membrane attachment to lowest part of pectoral base. Upper attachment of axial dermal flap opposite 7th (6-9) pectoral ray.

Dorsal-caudal distance forward often does not reach upper pectoral base but may extend past this point; postdorsal-caudal distance 2.3 (2.0-2.6) in dorsal length. Length of disc 2.9 (2.8-3.2) in standard length. Depressed tip of anal fin may extend to, or slightly beyond, a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are covered with a background of small, close-set, light-brown pigment spots. This is usually interrupted by wide, light-colored, vertical bars where the pigment spots are comparatively few. These bars are prominent on the posterior half of

h body, and sometimes may be found extending well forward on the head. h vertical fins, as well as their connecting membranes, are usually light rwn with transparent tips. Sometimes a distinct brown spot may be found the anterior base of the dorsal fin. In the pectoral fins only the rays r spotted with light brown, the connecting membranes remaining transent. The ventral surface of the body is considerably lighter, with only ctered light-brown spots.

RELATIONSHIP: This species is separated from its relatives by the chacers in the key. There is some chance of confusion with *G. daedaleus* deus and *G. d. brachysoma*, since the ranges overlap and the coloration is ite similar. However, *G. adustus* should stand out because of its relaely large eye, well-developed upper-lip papillae, and the greater numes of flattened papillae in disc region C.

MATERIAL EXAMINED: SU 16417; one specimen from Cape San Francisco, Ecuac. SU 17378; one, from Gorgona Island, Colombia. HF 1192; one, from ct Utria, Colombia. HF 1455; one, from Cupica Bay, Colombia. HF 1454; , from Taboga Island, Panama. SU 17374-17377; 12, from Bahia Honda, ama. ANSP 69990; one (paratype of *G. sapoensis* Fowler), from Playa rto, Panama. SU 17371-17373; 14, from Uvita Bay, Costa Rica. SU 17370; from Piedra Blanca Bay, Costa Rica. SU 17369; one, from Puerto Cule, Costa Rica. HF 737; one, from Playa Blanca, Costa Rica. SU 17366-68; 27, from Port Parker, Costa Rica. SU 17364-17365; five, from San n del Sur, Nicaragua. SIO (not numbered); six, from Puerto Marques, r Acapulco, Guerrero, Mexico. SU 17362-17363; seven, from Chamela Bay, isco, Mexico. USNM 29249; one (syntype of *G. adustus*), from Mazatlán, aloa, Mexico. UCLA field number W51-58; two, also from Mazatlán. UCLA ld number W51-54; 17, from Venados Island, Sinaloa, Mexico. HF 1453; r, from Los Frailes, Baja Calif., Mexico. HF 567; one, from Agua Verde , Baja Calif., Mexico. UCLA field numbers W50-33 and W50-35; three, m near San Carlos Bay, Sonora, Mexico. UCLA field number W51-29; four, m Lobos Island, Sonora, Mexico. UCLA field number W52-43; one, from t side of small bay between Las Tetas de Cabra and Point San Antonio, r Guaymas, Sonora, Mexico.

RANGE: From Cape San Francisco, Ecuador, to Guaymas, Sonora, Mexico, in Gulf of California.

REMARKS: This species has by far the greatest range of any Pacific *iesox*. It was formerly thought that *G. saxatilis* was a separate species examination of a syntype (USNM 29249) has shown otherwise.

Gobiesox milleri, new species

Figure 107

DIAGNOSIS: A *Gobiesox* with lobe-like papillae on head and along margin upper lip. Two very small papillae at center of upper lip. Body depth (4.3-4.9) and head length 2.4 (2.3-2.6) in standard length. Anus close anal fin origin. Eye 1.2 (1.2-1.3) in bony interorbital space and 5.4 8-6.0) in head. Each part of disc region C bears 4 (4-5) longitudinal ws of papillae; there are 9 (8-10) rows across width of disc region A. rsal rays 13 (12-14), anal rays 10, pectoral rays 25 (24-25), and caudal ys 12 (10-13).

DESCRIPTION: Body but slightly depressed; caudal peduncle short, least oth 1.0 (0.8-1.2) in its length. Anus under 3rd or 4th dorsal ray and ch closer to anal fin origin than to rear margin of disc.

Head well depressed and broad, width 2.5 (2.5-2.6) in standard length. out shallow with a flat outline, 3.1 (3.0-3.2) in head. Posterior nosil directly above anterior edge of eye; anterior nostril with a large, lobed, dermal flap extending from its posterior margin. Teeth of lower

jaw in 2 rows, those of the outer row much the larger; the front 6 (5-7 pairs compressed incisors with rounded (pointed in the young) tips. Thes incisors followed on each side by a row of canines. Teeth of upper ja conical, the larger toward the front, irregular in position, forming a dee patch toward front of jaw. Five or 6 short, rounded rakers on each of th two posterior gill arches.

Papillae on head and upper lip margin well developed but lobe-like i structure. From a frontal view, 2 rows of papillae evident on upper lip the first on the margin, the second consisting of 2 very small papillae be tween margin and premaxillary groove; none on snout above center of pre maxillary groove. One very small papilla on ventral side of head behin rictus. Upper attachment of gill membrane opposite 9th pectoral ray. Su opercular spine well developed; it protrudes through skin when pressure i applied. Fleshy pad on pectoral base conspicuous, with a free posterio margin extending from upper gill-membrane attachment to lowest part of pec toral base. Upper attachment of axial dermal flap opposite 8th (7-9) pec toral ray.

Dorsal-caudal distance forward extends to a point well in front of uppe pectoral base; postdorsal-caudal distance 2.3 (1.9-2.7) in dorsal length Length of disc 2.8 (2.6-3.0) in standard length. Depressed tip of anal fi extends to or beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides pale with scattere black markings. There is a concentration of black spots on the front o the head, and a large number of short black lines on the sides of the body The dorsal and anal fins each have two prominent longitudinal dark stripes one at the fin base and the other close to the distal edge. The caudal ha a dark vertical stripe across its base. The pectorals are very light wit a concentration of small black spots at the base. The ventral side of th body is very pale with only a few scattered black spots.

RELATIONSHIP: This species can be separated from the other members o the genus by the characters in the key. It is also distinguished by it coloration, the vertical dark stripe across caudal base being especiall noticeable, and by the presence of only 1 very small papilla on ventra side of head behind rictus.

HOLOTYPE: University of Michigan Museum of Zoology number 162460; 32.0 mm. in standard length, collected by Mr. D. S. Erdman at Cabello Island Gulf of Nicoya, Costa Rica, in July, 1951. It was found attached to a sub merged stick near a sand beach on the north coast.

PARATYPES: SU 17396; one specimen, 19.0 mm. in standard length, taken b the Eastern Pacific *Zaca* (1937-38) Expedition of the New York Zoologica Society at Cedros Island, Gulf of Nicoya, Costa Rica, on February 12, 1938 SU 17397; one, 14.8 mm. in standard length, also taken by the *Zaca* (1937 38) Expedition, at a night-light station at Golfito, Gulf of Dulce, Costa Rica, between March 4 and March 9, 1938. UCLA field number W54-48; one 19.0 mm. in standard length, from Rincon Beach, Cedros Island, Gulf o Nicoya, Costa Rica, on December 23, 1952, taken by Cliff Peterson an party. UCLA field number W54-174; one, 22.0 mm. in standard length, fro Costa Rica, taken on March 31, 1954.

DERIVATION OF NAME: This species is named for Dr. Robert R. Miller o the University of Michigan. He noted the unusual appearance of the holo type and kindly sent it to me for examination.

Gobiesox crassicorpus (Briggs)

Figure 108

Cotylis crassicorpus Briggs, 1951, p. 81, figs. 9, 10, and 19 (somewher between the Gulf of Nicoya, Costa Rica, and 30 miles south of Cap Corrientes, Jalisco, Mexico).

DIAGNOSIS: A *Gobiesox* with an extensive development of papillae on head, e forming finger-like projections. Three very small papillae at center upper lip. Body depth 4.3 and head length 2.5 in standard length. Anus se to anal fin origin. Eye 1.2 in bony interorbital space and 4.5 in d. Papillae in disc region C not distinct enough to count (this part well preserved); 10 rows of papillae across width of disc region A. sal rays 14, anal rays 10, pectoral rays 24, and caudal rays 12.

DESCRIPTION: Body little depressed; caudal peduncle short, least depth in its length. Anus directly under 5th dorsal ray. Standard length of gle known specimen 20.0 mm.

Head moderately depressed, width 2.4 in standard length. Snout rela- ely steep with a slightly rounded outline, 3.3 in head. Posterior nos- l directly above anterior edge of eye; anterior nostril with a small, obed, dermal flap extending from its posterior margin. Teeth of lower in 2 rows, those of the outer row much the larger; the front 5 pairs ll pointed incisors, followed on each side by a row of canines. Teeth upper jaw conical, the larger toward the front, irregular in position, ming a deep patch toward front of jaw. The holotype was not dissected obtain the gill-raker count.

All papillae on head extensively developed, some in the form of long ger-like projections. Four very small papillae above center of pre- cillary groove. Four small papillae on ventral side of head behind ric- s. Three small papillae on center of upper lip between margin and pre- cillary groove. Upper attachment of gill membrane occurs opposite 9th ctoral ray. Subopercular spine well developed; it projects from skin ler pressure. Fleshy pad on pectoral base conspicuous, with a free pos- rior margin extending from upper gill-membrane attachment to lowest part pectoral base. Upper attachment of axial dermal flap opposite 9th pec- al ray.

Dorsal-caudal distance forward reaches a point well in front of upper ctoral base; postdorsal-caudal distance 3.2 in dorsal length. Length of sc 3.0 in standard length. Depressed tip of anal fin extends slightly sterior to a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral surfaces of the body are vered with small rust-brown spots set close together. The ventral sur- ce and disc are a pale green. The dorsal and anal fins are semi-trans- rent, and each possesses two narrow, brown longitudinal stripes. The dal fin is dark brown at the base, becoming pale and transparent at the d, where two faint, vertical brown stripes can be seen. The pectoral s are lightly spotted with brown.

RELATIONSHIP: A highly specialized form which is separated from the er members of the genus by the characters in the key, with the addition the following: the striking green color of the ventral surface; the 4 ll papillae on ventral side of head behind rictus; and the relatively g snout, 3.2 in head.

MATERIAL EXAMINED: SU 39309; one specimen, the holotype. Locality not rtain.

RANGE: Needs yet to be definitely established. Somewhere between the lf of Nicoya, Costa Rica, and 30 miles south of Cape Corrientes, Jalisco, xico.

Gobiesox multitentaculus (Briggs)

tylis microspilus (*non* Fowler) Schultz, 1944, p. 64, pl. 1A (in part; Panama Bay to northern Peru).

tylis multitentaculum Briggs, 1951, p. 80 (Paita, Peru, to Cupica Bay, Colombia).

DIAGNOSIS: A *Gobiesox* with extensive development of papillae on head, some forming finger-like projections. Three very small papillae at center of upper lip. Head length 2.5 (2.4-2.6) in standard length. Anus close to anal fin origin. Eye 1.4-1.5 in bony interorbital space and 7.1 (6.9-7.2) in head. Each part of disc region C bears 6 (6-7) longitudinal rows of papillae; there are 12 (11-12) rows across width of disc region A. Dorsal rays 14-15, anal rays 10-11, pectoral rays 26 (24-27), and caudal rays 12-13.

DESCRIPTION: Body depressed, depth 5.6 (5.5-5.7) in standard length. Caudal peduncle medium, least depth 1.2 in its length. Anus located under 5th dorsal ray. Maximum known size 62.6 mm. standard length.

Head well depressed, width 2.6-2.7 in standard length. Snout shallow with a flat outline, 3.2 in head. Posterior nostril directly above anterior edge of eye; anterior nostril with a large, bilobed, dermal flap extending from its posterior margin. Teeth of lower jaw in 2 rows, those of the outer row much the larger; the front 4 pairs compressed incisors with rounded tips; followed on each side by a row of canines. Teeth at front of upper jaw conical, irregular in size and position, forming a deep patch toward front of jaw; teeth on each side slightly recurved and canine-like. Six shallow rakers on each of the two posterior gill arches.

Most of the papillae on head elongate and highly developed, some forming finger-like projections. One large and 2 very small papillae on ventral side of head behind rictus. From a frontal view, 2 rows of papillae are evident on upper lip, the lower row at margin, and the upper consisting of 3 very small papillae between margin and premaxillary groove; none on snout above center of premaxillary groove. Upper attachment of gill membrane opposite 7th pectoral ray. Subopercular spine well developed but hidden under skin of opercle region. Fleshy pad on pectoral base conspicuous, with a free posterior margin extending from upper gill-membrane attachment to lowest part of pectoral base. Upper attachment of axial dermal flap opposite 9th pectoral ray.

Dorsal-caudal distance forward extends well in front of upper pectoral base, and to a point closer to rear margin of eye than to pectoral base; postdorsal-caudal distance 2.9-3.0 in dorsal length. Length of disc 3.1 (2.9-3.2) in standard length. Depressed tip of anal fin extends to a point well beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are light brown and are covered with many close-set dark-brown spots and short streaks. This same pattern is found on the vertical and pectoral fins. The ventral surface is much lighter, being covered with relatively few scattered dark-brown spots.

RELATIONSHIP: This species is evidently the most highly specialized *Gobiesox*. It can be separated from the other members of the genus by the characters in the key. In addition, its known maximum size of 62.6 mm. is considerably greater than that known for its close relatives. It is also distinguished by the 1 large and 2 small papillae on ventral side of head behind rictus.

MATERIAL EXAMINED: USNM 107142; one specimen (holotype of *Cotylis multitentaculum*), from Paita, Peru. USNM 88823; one (paratype of *Cotylis multitentaculum*), from Salinas, Guayaquil, Ecuador.

RANGE: From Paita, Peru, to Cupica Bay, Colombia.

Gobiesox papillifer papillifer Gilbert

Gobiesox papillifer Gilbert, 1890a, p. 96 (Magdalena Bay, Baja California) —Jordan and Evermann, 1896, p. 491 (Magdalena Bay); 1898, p. 2330 (Magdalena Bay). —Starks and Morris, 1907, p. 231 (San Pedro).

istius papillifer Jordan, Evermann, and Clark, 1930, p. 488 (Magdalena Bay).—Barnhart, 1936, p. 93 (Magdalena Bay to San Pedro).
lis papillifer Schultz, 1944, p. 63 (Magdalena Bay, Baja California).—Briggs, 1951, p. 78 (from 3 miles north of Arroyo Seco, Baja California, Mexico, to San Pedro, California).

DIAGNOSIS: A *Gobiesox* with extensive development of papillae on head; e forming finger-like projections. Usually 3 very small papillae at er of upper lip. Head length 2.3 (2.3-2.4) in standard length. Anus e to anal fin origin. Eye 1.3 (1.2-1.8) in bony interorbital space and (5.0-6.8) in head. Each part of disc region C bears 4 (4-5) longitudi- rows of papillae; there are 10 (9-11) rows across width of disc region Dorsal rays 15 (14-15), anal rays 11 (10-11), pectoral rays 24 (23-25), caudal rays 12.

DESCRIPTION: Body depressed, depth 5.8 (5.2-6.5) in standard length. ial peduncle short, 1.0 (0.8-1.1) in its length. Anus located under 5th 6) dorsal ray. Maximum known size 48.2 mm. standard length.

Head depressed, width 2.5 (2.3-2.6) in standard length. Snout moderately shallow with a rounded outline, 3.3 (3.0-3.5) in head. Posterior ril directly above anterior edge of eye; anterior nostril with a large, bed, dermal flap extending from its posterior margin. Teeth of lower in 2 rows, those of the outer row much the larger; the front 3 pairs rfid incisors in the young, 4 pairs of rounded incisors in the larger cimens. These incisors followed on each side by a row of canines. th at front of upper jaw conical, the larger toward the front, irregir in position, forming a comparatively deep patch, followed on each side very slightly recurved canines. Six short rakers on each of the two terior gill arches.

Papillae on head extensively developed, some in form of long, fingerle projections; usually none occurring on snout above center of premaxlary groove. One large and 3 very small papillae on ventral side of head ind rictus. Upper attachment of gill membrane opposite 7th (6-8) pecal ray. Subopercular spine well developed but usually hidden by skin ering opercle region. Fleshy pad on pectoral base conspicuous, with a e posterior margin extending from upper gill-membrane attachment to est part of pectoral base. Upper attachment of axial dermal flap oppoe 8th (7-9) pectoral ray. Dorsal-caudal distance forward extends well front of upper pectoral base; postdorsal-caudal distance 3.3 (2.6-4.0) dorsal length. Length of disc 2.7 (2.6-2.8) in standard length. Dessed tip of last anal ray usually extends one-fifth its length or less ond a vertical line from caudal base.

COLORATION: In alcohol, dorsal and lateral sides are a uniform light y. The ventral surface is colorless and translucent except for a very ht gray color posterior to the disc. The dorsal, anal, and caudal fins gray-brown, the dorsal having a broad, light-colored stripe near the e; the tips of the rays of these fins are white. The pectorals are orless except for a series of small brown spots along each ray.

RELATIONSHIP: This species can be separated from the other members of genus by the characters in the key. It is also distinguished by its oration, usually a uniform light gray, and by the presence of 1 large 3 very small papillae on ventral side of head behind rictus.

MATERIAL EXAMINED: SU 18112; one specimen, from Banderas Bay, Jalisco, ico. SU 17399; one, from the southeast coast of Tiburón Island, Sonora, ico. UCLA field numbers W52-12 and 14; 46, from vicinity of Estero Solo, Guaymas, Sonora, Mexico. SU 17398; one, from Santa Inez Bay, Baja if., Mexico. SU 16399; one, from three miles north of Arroyo Seco, Baja if., Mexico. SU 16398; 34, from Estero de la Purisima, Baja Calif., ico.

RANGE: From Banderas Bay, Jalisco, Mexico, to the southeast coast Tiburón Island, Sonora, Mexico, in the Gulf of California, and north to S Pedro, California.

Gobiesox papillifer microspilus (Fowler)

Caulistius microspilus Fowler, 1916, p. 412, fig. 4 (Panama Bay).
Cotylis microspilus Briggs, 1951, p. 77 (San Francisco Bay to Panama Cit Republic of Panama).

DIAGNOSIS: A *Gobiesox* with extensive development of papillae on hea some forming finger-like projections. Three very small papillae at cent of upper lip. Head length 2.3-2.4 in standard length. Anus located clo to anal fin origin. Eye 1.1-1.2 in bony interorbital space and 5.0-6.2 head. Each part of disc region C bears 4-5 longitudinal rows of papilla there are 7-10 rows across width of disc region A. Dorsal rays 14, an rays 9-10, pectoral rays 24-25, and caudal rays 11.

DESCRIPTION: Body depressed, depth 5.7-5.8 in standard length. Caud peduncle medium, least depth 1.1-1.2 in its length. Anus under 5th dors ray. Maximum known size 37.0 mm. standard length.

Head well depressed, width 2.4-2.8 in standard length. Snout shall with a slightly rounded outline, 3.0-3.3 in head. Posterior nostril d rectly above anterior edge of eye; anterior nostril provided with a larg bilobed, dermal flap extending from its posterior margin. Teeth of low jaw in 2 rows, those of the outer row much the larger; the front 3 pai rounded incisors, followed on each side by a row of canines. Teeth front of upper jaw conical, the largest toward the front, irregular in p sition, forming a comparatively deep patch, followed on each side by a r of very slightly recurved canines. Six short, blunt rakers on the seco gill arch.

Papillae on head extensively developed, some in form of long, finge like projections. Four minute papillae on snout above center of prema illary groove. One large and 3 very small papillae on the ventral side the head behind the rictus. Upper attachment of gill membrane opposi 7th-8th pectoral ray. Subopercular spine well developed; it protrudes fr the skin under pressure. Fleshy pad on pectoral base conspicuous, with free posterior margin extending from upper gill-membrane attachment lowest part of pectoral base. Upper attachment of axial dermal flap opp site 8th-9th pectoral ray.

Dorsal-caudal distance forward extends to a point well in front of upp pectoral base; postdorsal-caudal distance 2.8-3.2 in dorsal length. Leng of disc 2.8-2.9 in standard length. Depressed tip of last anal ray exten for about one-fifth to one-third its length beyond a vertical line from t caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are light brow The head region is covered with many close-set spots of a slightly dark brown. Short, longitudinal lines of the same shade are present on the do sal side of the posterior body. The median and pectoral fins are all lig brown with the tips of the rays in the median fins being colorless. addition, the dorsal fin shows two longitudinal light stripes a short di tance above the base. The ventral body surface is very light and trans lucent, with only scattered, light-brown spots on the posterior body behi the disc.

RELATIONSHIP: This species can be separated from the other members the genus by the characters in the key. It is also distinguished by i coloration, dorsal side of body light brown, and by presence of 1 large a 3 very small papillae on ventral side of head behind rictus.

This form is quite closely related to *G. papillifer*, yet is well separ-
d geographically. Since it seems quite likely that intergrades between
two will be found when the intervening region has been more thoroughly
ied, it seems best to designate this a subspecies of *G. papillifer*.
MATERIAL EXAMINED: SU 16397; one specimen from San Francisco Bay,
nt miles south of Panama City, Panama. ANSP 45213; one (holotype of
listius microspilus), from Panama.
RANGE: San Francisco Bay to Panama City, Panama.

Genus *ACYRTUS* Schultz

Figures 12, 65; Map 10

rtus Schultz, 1944, p. 56 (type species *Sicyases rubiginosus* Poey, 1868,
by original designation).

Body moderately depressed anteriorly; head somewhat triangular in dorsal
line with the blunt snout projecting a little instead of being contin-
s with head. Head depressed, length 2.2-2.7 and width 2.3-2.8 in stand-
length. A few very shallow, fleshy lobes beneath lower jaw, but not
ewhere on head. Nostrils on each side well separated, distinctly tubu-
. Upper lip, as delineated by premaxillary groove, wide at front of
ut, narrowing rapidly at sides.
Teeth of lower jaw in 2 rows, those at the front rounded or weakly tri-
incisors, followed on each side by weak canines. A deep patch of
nded incisors at front of upper jaw, followed on each side by weak ca-
es and/or small conical teeth. Six, shallow, pointed rakers on each
l arch. Edges of gill membranes attached laterally very close to upper
toral base. A very poorly developed fleshy pad usually present on outer
toral base, without a free posterior margin.
The median fins are all quite short. Dorsal rays 8-10, anal rays 7-9,
caudal rays 7-9. Pectoral rays vary from 24-26. Usually the first 2
sal rays much reduced and not externally visible, except on very small
cimens in which the fin membranes are thin and semi-transparent. In the
e way, the first anal ray usually also reduced. For identification,
n time for dissection or clearing and staining cannot be spared, it is
ally safe to add 2 to the external dorsal ray count and one to the ex-
nal anal ray count in this genus.
Disc medium to large, length 2.3-3.2 in standard length. Arrangement of
shallow flattened papillae on ventral surface considerably different
each of the two species (fig. 37). Bony support of disc has a charac-
istic shape (fig. 65). Pelvic girdle comparatively narrow, and distal
tcleithral bones have a distinctive outline.
An interesting external sexual dimorphism is apparent in both species.
female has a large patch of small, fleshy projections just anterior to
anus (fig. 12), while in the male this area remains perfectly smooth.
re are 28 vertebrae.
The life color of both species is said to be predominantly red.
As far as is known, this genus is confined entirely to the Western North
antic, from Curaçao Island north through the Greater Antilles. None
been taken from fresh water.
This genus was originally described by Schultz to include *Gobiesox*
nicola) beryllinus Hildebrand and Ginsburg. Unfortunately, Schultz
ught that *G. beryllinus* was a synonym of *Sicyases rubiginosus* Poey, and
ignated this latter form as the type species. He later found (Schultz,
, p. 244), upon examination of the type of *S. rubiginosus*, that the two
cies were not the same, and that Poey's fish was identical with the form

that Schultz (1944, p. 72) called *Arcos macrophthalmus*. He then proposed a new generic name, *Acyrtops*, for *Gobiesox beryllinus*, allowing his *Acyrtus* to replace *Arcos*.

In the present revision, it has been necessary to split Schultz' amended *Acyrtus* into two genera, so that both *Arcos* and *Acyrtus* are now utilized for good taxonomic genera. It is unfortunate that the name *Acyrtus*, referring to the absence of a dorsal curve of the premaxillary groove, must now identify a group which does possess this characteristic curve.

Key to the Species of *Acyrtus*

1a. Head length 2.2-2.3 in standard length; disc length 2.3-2.6 in standard length; 8-9 rows of flattened papillae across width of disc region A; 9-10 rows across width of disc region B; 3-4 rows across width of each part of disc region C; anus slightly closer to rear margin of disc than to anal fin origin.....*artius* (p. 126)

1b. Head length 2.5-2.7 in standard length; disc length 2.8-3.2 in standard length; 5-6 rows of flattened papillae across width of disc region A; 5-7 rows across width of disc region B; no papillae in disc region C; anus usually closer to anal fin origin than to rear margin of disc.....*rubiginosus* (p. 127)

Acyrtus artius, new species

Figures 37, 109

Gobiesox cephalus (*non* Lacépède) Metzelaar, 1922, p. 139 (Caracasbay).

DIAGNOSIS: A very small *Acyrtus* with a large head, length 2.2 or 2.3 in standard length. Disc also large, length 2.4 (2.3-2.6) in standard length. Eight or 9 rows of flattened papillae across width of disc region A; 9 or 10 rows across width of disc region B; 3 or 4 longitudinal rows across width of each part of region C. Anus slightly closer to rear margin of disc than to anal fin origin. Dorsal rays 9 (8-9), anal rays 7, pectoral rays 24 (24-25), and caudal rays 8 or 9.

DESCRIPTION: Body lightly depressed, depth 4.2 or 4.3 in standard length. Caudal peduncle medium, least depth 1.3 (1.2-1.4) in its length. Maximum known size about 22.0 mm. standard length.

Head depressed, width 2.4 (2.3-2.5) in standard length. Snout steep with a rounded outline, 3.8 (3.7-4.0) in head. Posterior nostril just in front of anterior edge of eye; anterior nostril with a narrow, branched dermal flap extending from its posterior margin. Teeth at front of lower jaw 4 or 5 pairs of rounded or weakly trifid incisors, followed on each side by 3 weak canines. Teeth at front of upper jaw rounded incisors; no canines present.

Greatest diameter of eye 0.5 (0.3-0.6) in bony interorbital space and 3.2 (2.8-3.6) in head. Gill membrane attached opposite 2nd (1-3) pectoral ray. Preopercular spine well developed and protrudes upon application of little pressure. Upper attachment of axial dermal flap opposite the 8th pectoral ray.

Dorsal-caudal distance forward extends to proximal half of pectoral fin; postdorsal-caudal distance 1.1 (1.0-1.2) in dorsal fin length.

COLORATION: In alcohol, the specimens are very pale and colorless. No dark pigment spots can be seen. In life, the color is probably red.

RELATIONSHIP: According to the material presently available this species is quite distinct from the other member of the genus. The most useful characters are: size of head, size of disc, and pattern of papillae on sur

a of disc (fig. 37).

OLOTYPE: Stanford University number 23254; a male, 18.2 mm. in standard e:th, from Caracasbay, Curaçao Island, Netherlands West Indies, collected r. C. J. Van Der Horst, on May 3, 1920.

ARATYPES: SU 47942; one, a female, 18.4 mm. in standard length, col-e:ed with the holotype. AM (unnumbered); two, also from Curaçao Island, S1 78158; one, from St. Thomas, Virgin Islands.

ERIVATION OF NAME: The name is from the Greek *artios*, perfect, and re-e; to the fact that this species does possess papillae in disc region C.

Acyrtus rubiginosus (Poey)

Figure 37

iyases rubiginosus Poey, 1868, p. 391 (Palmasola, Matanzas, Cuba); 1875, p. 124 (Cuba).—Jordan, Evermann, and Clark, 1930, p. 490 (Matanzas, Cuba).

iyases carneus Poey, 1868, p. 392 (Palmasola, Matanzas, Cuba); 1875, p. 124 (Cuba).—Jordan, Evermann, and Clark, 1930, p. 490 (Matanzas, Cuba).

ciesox rubiginosus Jordan and Evermann, 1896, p. 492 (Matanzas, Cuba); 1898, p. 2337 (Cuba).

ciesox carneus Jordan and Evermann, 1896, p. 492 (Matanzas, Cuba); 1898, p. 2337 (Cuba).

ciesox tudes (*non* Richardson) Evermann and Marsh, 1902, p. 305 (Culebra Island, Porto Rico).

ciesox androsiensis Rosén, 1911, p. 65 (Mastic Point, Andros Island, and Nassau, Bahamas).

ciesox cerasinus (*non* Cope) Fowler, 1919, p. 149 (Jamaica).

ciesox macrophthalmus (*non* Günther) Beebe and Tee-Van, 1928, p. 251, fig. (Lamentin Reef, Port-au-Prince Bay, Haiti).

iyases yumurina Howell Rivero, 1936, p. 74 (Matanzas, reef at entrance of the bay).

os macrophthalmus (*non* Günther) Schultz, 1944, p. 72 (in part; Bahama Islands and West Indies).

DIAGNOSIS: A small *Acyrtus* with a medium sized head, length 2.6 (2.5-.) in standard length. Disc also medium in size, length 3.0 (2.8-3.2) in ndard length; 6 (5-6) rows of flattened papillae across width of disc ion A; 6 (5-7) rows across width of disc region B; no papillae in disc ion C. Anus usually closer to anal fin origin than to rear margin of ic. Dorsal rays 9 (9-10), anal rays 8 (7-9), pectoral rays 26 (25-26), caudal rays 8 (7-9).

DESCRIPTION: Body moderately depressed, depth 5.1 (4.9-5.4) in standard gth. Caudal peduncle medium, least depth 1.7 (1.3-2.3) in its length. imum known size 29.7 mm. standard length.

Head depressed, width 2.6 (2.5-2.8) in standard length. Snout steep h a rounded outline, 3.8 (3.3-4.3) in head. Posterior nostril in front anterior edge of eye; anterior nostril with a large, multibranched, der- flap extending from its posterior margin. Teeth at front of lower jaw 3-7) pairs of rounded incisors, followed on each side by 3 (2-3) canines. th at front of upper jaw 3 (2-3) pairs of rounded incisors, followed on h side by 2 (1-3) weak canines.

Greatest diameter of eye 0.6 (0.4-0.7) in bony interorbital space and (3.0-3.8) in head. Gill membrane attached opposite 3rd (2-4) pectoral . Subopercular spine well developed; it protrudes upon application of a tle pressure. Upper attachment of axial dermal flap opposite 11th (10- pectoral ray.

Dorsal-caudal distance forward usually extends to proximal one-half of pectoral fin; postdorsal-caudal distance 0.9 (0.8-1.0) in dorsal length.

COLORATION: In alcohol, the entire body a uniform, light reddish color, or else very pale and colorless. No dark pigment spots can be seen.

According to a communication from Mr. Charles C. G. Chaplin of the Philadelphia Academy of Natural Sciences, the color in life is usually a uniform dark red. Occasionally, however, individuals are found with a series of heavy dark-brown bands running laterally across the dorsal surface.

RELATIONSHIP: This species is quite distinct from *A. artius*, and is separated by such characters as size of head, size of disc, and distribution of papillae on surface of disc (fig. 37).

MATERIAL EXAMINED: ANSP (unnumbered); one specimen, from Barbados Island. MCZ 12923; one (syntype of *Sicyases rubiginosus*), from Matanzas, Cuba. MCZ 34153-34154; three (holotype and two paratypes of *Sicyases yumurina*), from Matanzas. USNM 153579 and 167863; three (two syntypes of *Sicyases carneus* and a paratype of *Sicyases yumurina*), from Matanzas. MU 876; 28, from Nicholstown, Andros Island, Bahamas. MU 871; two, from southwest shore, Cotton Cay, Anguila Islands, Cay Sol Bank, Bahamas. MU 873-874; two, from ocean side of Rabbit Key, Bimini, Bahamas. KZM 30.8. 1866; one, from the West Indies.

RANGE: Barbados Island to Jamaica, Cuba, and the Bahamas.

REMARKS: A specimen identified by Dr. A. W. Herre (1942b, p. 20) as *Sicyases carneus* Poey is supposed to be in the Stanford Collection, but could not be located. The characters given in his description are not sufficient to allow a positive identification.

Mr. Charles C. G. Chaplin reports that these little fish are almost always found in pools and holes where there is a considerable play of surf against a clean, rocky shore, where the bottom is not easily stirred up. In the Bahamas, they often hide under a species of sea urchin, *Diadema*, short-spined and reddish, which lives in small rounded pockets in the eroded limestone of the exposed northern shores of the islands.

Genus *PHERALLODISCUS*, new

Figures 13, 38, 66; Map 9

Type species: *Gobiesox funebris* Gilbert, 1890.

Body broad and depressed anteriorly; tadpole-shaped in dorsal outline with snout not projecting but continuous with head. Head depressed, length 2.6-3.0 and width 3.2-3.6 in standard length. Anus closer to anal fin origin than to rear margin of disc. The only papillae on head are a few shallow lobes beneath lower jaw, and at extremities of gape. Nostrils on each side well separated, distinctly tubular. Upper lip, as delineated by premaxillary groove, wide at front of snout, narrowing rapidly at sides.

Teeth at front of lower jaw compressed incisors with rounded tips, followed on each side by a row of very slightly recurved canines. A deep patch of much smaller conical teeth behind the incisors. Teeth at front of upper jaw conical, the larger at the front, irregularly placed, forming a comparatively deep patch, followed on each side by a row of conical teeth or very slightly recurved canines.

Six or 7 very shallow, blunt rakers on each side of the two posterior gill arches (not counted in *P. varius*). Gill membranes attached laterally very close to pectoral fin base. A swollen, fleshy pad on outer pectoral base, with no free, vertical posterior margin.

Dorsal, anal, pectoral, and caudal fins all comparatively short, with t

ency toward a lower ray count in *P. varius* than in *P. funebris*. Dor- rays 9-11, anal rays 6-8, pectoral rays 16-20, and caudal rays 7-10. lly the first 2 dorsal and anal rays very much reduced and not exter- y visible, except on very small specimens in which fin membranes are and semi-transparent. For identification, when time for dissection learing and staining cannot be spared, it is usually safe to add 2 to external dorsal and anal ray counts in this genus.

isc medium sized, length 3.1-4.1 in standard length; it shows a char- ristic arrangement of the shallow, flattened papillae on its ventral ace (fig. 38). The bony disc support is very similar to that de- bed for the genus *Gobiesox* (fig. 64). The only differences apparent in red and stained specimens are minor ones in shape of anterior portion leithrum, and considerably broader distal postcleithral bones (from a al view) in region of symphysis (fig. 66).

n both species external sexual dimorphism is evident in size and shape rogenital papilla (fig. 13). *Pherallodiscus varius* is further remark- for a unique modification of the lower pectoral and ventral fin rays he male. As can be seen in figure 111, the 3rd ventral ray and, to an greater extent, 4 of the lower pectoral rays are considerably elon- ed and swollen at the tips. There are 28 vertebrae in *P. funebris*, and number in *P. varius* is probably close to this figure.

This genus is confined, as far as known, entirely to the Pacific coast Mexico. The name *Pherallodiscus* is from the Greek *phero*, to bear; *bios*, different; and *diskos*, a flat, circular plate.

Key to the Species of *Pherallodiscus*

a Eye in small specimens (under 25.0 mm. standard length) 1.3 (1.2-1.3) in bony interorbital space; no enlargement of pectoral or ventral rays in males; caudal rays 10; head width 3.3 (3.2-3.6) in standard length; usually 3 rows of papillae across width of disc region B; color of dor- sal side of body blackish.....*funebris* (p. 129)

t. Eye in small specimens (under 25.0 mm. standard length) 1.6 (1.5-1.7) in bony interorbital space; 4 of the lower pectoral rays and the 3rd ventral ray elongate and swollen in males; caudal rays 8 (7-9); head width 3.6 in standard length; 2 rows of papillae across width of disc region B; color of dorsal side of body light-brown....*varius* (p. 131)

Pherallodiscus funebris (Gilbert)

Figure 110

iesox funebris Gilbert, 1890a, p. 95 (Puerto Refugio, Angel Island, and La Paz, Gulf of California).—Jordan and Evermann, 1896, p. 491 (Gulf of California); 1898, p. 2334 (Ángel Island and La Paz, Gulf of California).—Osburn and Nichols, 1916, p. 177 (San Francisquito Bay).—Jordan, Evermann, and Clark, 1930, p. 489 (Gulf of California).—Breder, 1936, p. 48 (Puerto Refugio).—Schultz, 1944, p. 77 (Gulf of California).—Briggs, 1951, p. 75 (La Paz to Puerto Refugio, Gulf of California).

iesox macrurus Briggs, 1951, p. 70 (near Guaymas and Punta Peñasco, Sonora, Mexico).

DIAGNOSIS: A large *Pherallodiscus*, very common in the Gulf of Califor- .. Eye 1.5 (1.2-1.8) in bony interorbital space and 6.5 (5.0-8.0) in d. Usually 3 (2-3) rows of papillae across width of disc region B. d width 3.3 (3.2-3.6) in standard length. Dorsal rays 11 (10-11), anal

rays 7 (7-8), pectoral rays 19 (17-20), and caudal rays 10.

DESCRIPTION: Body only slightly depressed, depth 6.1 (5.0-7.2) in stan dard length. Caudal peduncle short, least depth 0.9 (0.7-1.0) in its length. Anus located in front of dorsal origin and closer to anal fi origin than to rear margin of disc. Maximum known size 75.0 mm. standar length.

Head depressed, length 2.7 (2.6-2.9) in standard length. Snout shallo with a flat outline, 3.1 (2.9-3.7) in head. Posterior nostril directly above anterior edge of eye; anterior nostril with a conspicuous, biloped dermal flap extending from its posterior margin. Teeth at front of lowe jaw 4 (3-5) pairs of compressed incisors with rounded tips, followed o each side by a row of very slightly recurved canines. A deep patch of muc smaller conical teeth behind the incisors. Teeth at front of upper ja conical, the larger at the front, irregular in position, forming a compar atively deep patch, followed on each side by a row of very slightly re- curved canines. Six or 7 shallow, blunt rakers on each of the two post- erior gill arches.

All papillae on head shallow, lobe-like, confined to lower jaw an around extremities of gape. Greatest diameter of eye 1.7 (1.4-1.8) in bon interorbital space and 7.0 (6.5-8.0) in head of larger specimens (thos over 25.0 mm. in standard length). An eye measurement of 1.3 (1.2-1.3) i the bony interorbital space and 5.8 (5.0-6.4) in head was found in th smaller specimens of the series (those under 25.0 mm. in standard length) Upper attachment of gill membrane occurs opposite 6th (5-8) pectoral ray. Subopercular spine comparatively small and hidden under heavy skin o opercle region. Fleshy pad on pectoral base swollen and rounded in shape without a free, vertical, posterior margin. Upper attachment of axial der mal flap opposite 5th (4-6) pectoral ray.

Dorsal-caudal distance forward does not extend as far as upper pectora base; postdorsal-caudal distance 2.0 (1.9-2.0) in dorsal length. Length o disc 3.6 (3.4-4.0) in standard length. Depressed tip of anal fin usuall reaches or extends slightly beyond a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides of the body ar heavily mottled with black over a light-gray background. The dorsal side o the head is usually lighter with fewer black areas. The median fins, in cluding the membrane between the rays, are usually blackish. The pectora fin is somewhat lighter. The ventral posterior side is light gray whil the ventral anterior portion, including the disc, is semi-transparent wit very little pigment.

RELATIONSHIP: This large dark-colored species is quite closely relate to the other species in this genus, but is readily separated by means o the several characters in the key.

MATERIAL EXAMINED: SU 20; nine specimens (syntypes of *G. funebris*) fro La Paz, Baja Calif., Mexico. SU 16420; 81 (paratypes of *Gobiesox mac- rurus*), from Ensenada San Francisco near Guaymas, Sonora, Mexico. S 32227; one, from Red Bluff Bay, Tiburón Island, Sonora, Mexico. SU 17803 33, from between Mejia and Ángel de la Guardia Islands, Baja Calif., Mex ico. SU 17801; one (a syntype of *G. funebris* received in exchange from th USNM), from Puerto Refugio, Ángel de la Guardia Island, Gulf of California SU 16421; 23 (paratypes of *G. macrurus*), from Punta Peñasco Bay, Sonora Mexico. SU 16419; one (holotype of *G. macrurus*), from Punta Peñasco, Sonora, Mexico.

RANGE: The Gulf of California from La Paz, Baja Calif., Mexico, to Punt Peñasco, Sonora, Mexico.

REMARKS: *Gobiesox macrurus* was described as new because of apparentl specific differences in the specimens at hand and the unsatisfactory des criptions of *G. funebris* in the literature. However, an examination of syntype of the latter species from the U.S. National Museum revealed tha

. *acrurus* is not distinct. Nine syntypes, subsequently found in the t:ford Collection, confirmed this.

Pherallodiscus varius, new species

Figure 111

)IAGNOSIS: A very small *Pherallodiscus* with a unique type of sexual i:rphism (see above and fig. 111). Eye 1.6 (1.5-1.7) in bony interor- i:l space and 6.8 (6.1-7.6) in head. Two rows of papillae across width f:isc region B. Head width about 3.6 in standard length. Dorsal rays 9-10), anal rays 7 (6-7), pectoral rays 17 (16-18), and caudal rays 8 7)).

)ESCRIPTION: Body only slightly depressed, depth 5.8 (5.7-6.1) in stan- a:d length. Caudal peduncle short, least depth 0.7 (0.7-0.8) in its e:gth. Anus in front of dorsal fin origin or under 1st dorsal ray, and :ser to anal fin origin than to rear margin of disc.

Head depressed, length 2.9 (2.8-3.0) in standard length. Snout flat- :ed with a very shallow outline, 3.1 (3.0-3.2) in head. Posterior nos- r:l directly above anterior edge of eye; anterior nostril with a conspic- o:s, bilobed, dermal flap extending from its posterior margin. Teeth at r:t of lower jaw 5 (5-6) pairs of compressed incisors with rounded tips, o:lowed on each side by a row of very slightly recurved canines. A deep :ch of much smaller conical teeth behind the incisors. Teeth at front of p:er jaw conical, the larger at the front, irregular in position, forming : omparatively deep patch, followed on each side by a row of very slightly :urved canines. Specimens were too small to obtain an accurate gill- :er count.

All papillae on head shallow lobe-like structures confined to lower jaw : around the extremities of gape. Upper attachment of gill membrane p:osite 6th (6-7) pectoral ray. Subopercular spine fairly well developed, : concealed under heavy skin of opercle region. Fleshy pad on pectoral :e small, swollen and rounded in shape without a free, vertical posterior :gin. Upper attachment of axial dermal flap opposite 5th (4-6) pectoral :.

Dorsal-caudal distance forward extends to a point well behind upper pec- r:l base; postdorsal-caudal distance 2.1 (1.8-2.4) in dorsal length. :gth of disc 3.9 (3.6-4.1) in standard length. Depressed tip of anal fin :ends well past a vertical line from caudal base.

COLORATION: In alcohol, the dorsal and lateral sides are an even light- :wn color. This same shade is found on the rays of the vertical fins, :ept that the connecting membranes between these rays are transparent. :ll dark-brown spots are found at the base of the pectoral and along each : the rays. The connecting membranes are transparent in this fin also. : ventral posterior body is well pigmented with very small light-brown :ts, but the ventral anterior portion, including the disc, is semi-trans- r:ent with very little pigment.

RELATIONSHIP: This small species is quite closely related to the other :cies is this genus, *P. funebris*, but is readily separated by means of : several characters in the key.

HOLOTYPE: Stanford University number 17807; a male, 17.8 mm. in standard :ngth. This specimen was taken by the Eastern Pacific *Zaca* (1937-38) Ex- :dition of the New York Zoological Society at Passavera Island, Chamela :y, Jalisco, Mexico, on November 19, 1937.

PARATYPES: SU 17808; a male, 17.7 mm. and a female, 18.4 mm. in standard :ngth, taken with the holotype.

DERIVATION OF NAME: From the Latin *varius*, different, referring to the :culiar sexual dimorphism found in this species.

Subfamily ASPASMINAE, new

Gills three; gill membranes attached to isthmus; disc double. There are three genera and three species; all are found in the tropical Western Pacific.

ARTIFICIAL KEY TO THE GENERA OF ASPASMINAE

1a. Prominent vertical ridges on sides of body; no gill rakers; disc small, length 4.2 in standard length.....*Liobranchia* (p. 132)
1b. No prominent vertical ridges on sides of body; about 8 well-developed rakers on second gill arch; disc length either greater (3.5-3.9) or less (4.8-5.2) than 4.2 in standard length.
2a. Dorsal rays 11-13[1]; disc length 3.5-3.9 in standard length; head length 2.4-2.8 in standard length.....*Aspasmichthys* (p. 133)
2b. Dorsal rays 7-9[1]; disc length 4.8-5.2 in standard length; head length 3.2-3.6 in standard length.....*Aspasma* (p. 135)

Genus *LIOBRANCHIA*, new

Figure 39; Map 14

Type species: *Liobranchia stria*, new.

Body compressed both anteriorly and posteriorly, and marked by a series of deep, perpendicular ridges. Head small, rounded, and only slightly depressed. Mouth small, inferior; upper lip short and narrow.

A single row of very narrow, small incisors with rounded tips in each jaw. Gill arches smooth, rakers entirely absent. Edges of gill membranes attached a short distance in front of pectoral base and below upper origin of pectoral fin. No fleshy swelling or pad on lowest part of pectoral base.

Dorsal and anal fins short. Pectoral fin fairly well developed, with a moderately large number of rays. Median fin rays can be counted easily, but first pectoral ray is quite small and might be overlooked. Disc small, rounded, and, from a ventral view, the external features are highly characteristic (fig. 39). It may be noted that the smooth central area is small, while the portions occupied by the flattened papillae and the ventral fin rays are comparatively large.

Due to the very small size of the single specimen of the one species in this genus, it was not possible to determine the presence or absence of the subopercular element. There is, however, no spine at posterior part of side of head. Since it was considered undesirable to clear and stain the holotype of *L. stria*, nothing is known about shape of pelvis and distal postcleithral bones or the premaxillaries. Several X-rays were taken, but the small size of the specimen prevented adequate visualization of the pertinent bony parts. It was not even possible to obtain a satisfactory vertebral count. There are apparently 6 branchiostegals on each side.

This is a monotypic genus known so far from a single specimen from Saipan Island. The name is from the Greek *leios*, smooth; and *branchia*, gills of fishes.

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[1]Add one to dorsal ray count unless this fin is dissected.

Liobranchia stria, new species

Figure 112

DIAGNOSIS: A small, peculiar clingfish with sides marked by a prominent series of vertical ridges, a compressed body, and a small, inferior mouth. Dorsal rays 7, anal rays 7, pectoral rays 24, and caudal rays 8.

DESCRIPTION: Body well compressed, depth 5.0 in standard length. Caudal peduncle medium, depth 1.2 in its length. Anus slightly closer to origin of anal fin than to rear margin of disc. Head small and rounded, length 3.2 and width 3.7 in standard length. Snout very short and rounded in dorsal outline, 3.5 in head. Anterior nostril simple, without a dermal flap on the margin; posterior nostril in front of anterior edge of eye. Eye 1.1 in bony interorbital space and 4.1 in head.

Upper attachment of gill membrane opposite 8th pectoral ray. Upper attachment of axial dermal flap opposite 6th pectoral ray. Postdorsal-caudal distance in dorsal length 0.9; dorsal-caudal distance forward extends to distal one-fourth of pectoral fin. Disc length 4.2 in standard length; disc region A with 6 rows of flattened papillae across its width; disc region B also with 6 rows across its width.

COLORATION: All pigmentation has been lost from this specimen.

RELATIONSHIP: A most peculiar and highly modified species having little resemblance to any other known clingfish. The general body shape is quite similar to that of some of the small gobies. As far as is known, the only other fish showing such prominent vertical ridges on the body is the pygidid catfish *Rhizosomichthys totae* (Miles) from the Río Magdalena in Colombia.

HOLOTYPE: U.S. National Museum number 149910, 18.3 mm. in standard length, taken from a lagoon west of Saipan Island, Marianas Islands, between May 4 and July 2, 1949, by Dr. Preston E. Cloud.

DERIVATION OF NAME: From the Latin *stria*, a furrow, in reference to the vertical furrows between the ridges on the sides of this fish.

Genus *ASPASMICHTHYS*, new

Figures 40, 67, 71, 78; Map 14

Type species: *Aspasma ciconiae* Jordan and Fowler, 1902.

Body medium in width and depressed anteriorly; head medium and depressed with a protruding, flattened snout. Upper lip comparatively broad and protrorse, wider at sides of snout than at front. A narrow cutaneous fold usually can be seen extending laterally across bridge of snout.

A shallow cluster of small conical teeth at tip of each jaw. Sides of jaws with a single row of compressed teeth with sharp reverse points (fig. 7). Eight short, pointed rakers present on the second gill arch. Edges of gill membranes attached laterally a short distance in front of pectoral base, and well below upper origin of pectoral fin. A small fleshy swelling present on lowest part of pectoral base.

Fins all of medium length. Anal ray count can be taken easily, but the first dorsal and first pectoral rays are very small and apt to be overlooked. Disc medium in size and rounded; pattern of papillae on ventral surface characteristic (fig. 40), papillae usually absent at the very center of region A. Disc region C tends to be quite narrow across central portion.

Subopercular element present and forms the terminal bone posteriorly on side of head. It has no spine. Both pelvis and distal postcleithral bones characteristic in shape from a ventral view (fig. 67); the latter bones

both notched to articulate directly with the enlarged posterior portion of pelvis. Premaxillaries considerably narrower and more elongate than in the genus *Aspasma* (figs. 78 and 79); perforated anteriorly by a median opening which seems to have a distinctive shape (fig. 78). There are 33 vertebrae, and 6 branchiostegals.

There is no externally apparent sexual dimorphism.

This is a monotypic genus confined to the area between Taiwan and Japan. The name is taken from *Aspasma* Jordan and Fowler, to which this genus is closely related.

Aspasmichthys ciconiae (Jordan and Fowler)

Aspasma ciconiae Jordan and Fowler, 1902, p. 415, fig. (Wakanoura, Japan). —Jordan, Tanaka, and Snyder, 1913, p. 378, fig. 338 (Wakanoura). —Tanaka, 1913b, p. 133, fig. 339. —Okada and Matsubara, 1938, p. 378, pl. 89, fig. 2. —Okada, 1938, p. 249 (Honsyu, Kyusyu, Ryukyu, Taiwan); 1951, p. 39 (Wagu-ôshima, Mie, Japan). —Mori, 1952, p. 193 (Quelpart Island, Korea).

DIAGNOSIS: A large clingfish with a well-depressed head and body and a prominent snout. Dorsal rays 12 (11-13), anal rays 9 (8-9), pectoral rays 23, and caudal rays 11 (10-11).

DESCRIPTION: Body of medium width and well depressed anteriorly, depth 6.4 (6.2-6.7) in standard length. Caudal peduncle short, depth 0.8 (0.8-0.9) in its length. Anus usually closer to anal fin origin than to rear margin of disc. Head large and well depressed, length 2.6 (2.4-2.8) and width 3.7 (3.5-3.8) in standard length. Snout large and protruding in dorsal outline, 3.1 (3.0-3.2) in head. Anterior nostril with a small, simple, dermal flap attached to its posterior margin; posterior nostril usually just above or behind anterior edge of eye. Eye 0.8 (0.6-0.9) in bony interorbital space and 4.4 (3.8-5.0) in head.

Upper attachment of gill membrane opposite 5th (3-7) pectoral ray. A slight swelling present on lowest portion of outer pectoral base, but no well-developed fleshy pad. Upper attachment of axial dermal flap opposite 11th (10-11) pectoral ray. Postdorsal-caudal distance in dorsal length 2.4 (2.2-2.7); dorsal-caudal distance forward extends to tip of pectoral fin or to a point just behind it. Disc length 3.7 (3.5-3.9) in standard length; Usually no flattened papillae in central part of disc region A; disc region B with 8 (6-10) rows across its width; 2 (1-3) rows across width of disc region C. Maximum known size 56.0 mm. standard length.

COLORATION: No coloration was present in the alcohol specimens examined. In the original description, Jordan and Fowler (1902, p. 415) gave the color as a uniform pale brown with a red tint behind the eyes and on the caudal. Tanaka (1931b, fig. 339) has published a colored plate of this species which shows the dorsal and lateral sides to be a yellowish pink and the fins bluish with pink rays. The ventral surface is very pale.

RELATIONSHIP: A distinctive species not closely related to any other known form.

MATERIAL EXAMINED: UMMZ 162006-7; three specimens from near Ezumi, Shimane, Japan. UMMZ 162005; four, from Hamada, Shimane, Japan. SU 7136; one (holotype of *Aspasma ciconiae*), from Wakanoura, Japan. USNM 50760; one (paratype of *Aspasma ciconiae*), also from Wakanoura.

RANGE: Taiwan through the Riu Kiu Islands north to Quelpart Island, Korea, and to Wakanoura, Japan.

Genus *ASPASMA* Jordan and Fowler

Figures 41, 68, 71, 79; Map 14

Aspasma Jordan and Fowler, 1902, p. 414 (type species *Lepadogaster minimus* Döderlein, 1887, by original designation).

Body narrow and rounded anteriorly and well compressed posteriorly; head depressed, with a short, blunt snout. Mouth small; upper lip medium in width, retrorse, about same size on sides of snout as at front. Bridge of snout smooth.

Upper jaw with 2 rows of incisors, the inner row consisting of only a few very small teeth at front of jaw, the outer row large, well-developed teeth, those at the front with rounded tips, while the more posterior incisors have bluntly pointed, reverse tips (fig. 71). Lower jaw with a single row of rounded or squarish incisors. Eight short, blunt rakers on the second gill arch. Edges of gill membranes attached laterally a short distance in front of pectoral base and below upper origin of pectoral fin. A fleshy swelling or pad on lowest part of pectoral base.

Fins all of medium length. Rays in median fins may be counted easily, but the first pectoral ray very small and apt to be overlooked. Disc small and rounded, with a characteristic pattern of papillae on ventral surface (fig. 41); the entire central portion of disc region A is smooth.

Subopercular element present, forming the terminal bone posteriorly on side of head. It has no spine. Both pelvis and distal postcleithral bones have a characteristic shape from a ventral view (fig. 68); the latter structures are closely applied to posterior end of pelvis but evidently not notched to fit, as in the genus *Aspasmichthys* (fig. 67). Premaxillaries comparatively broad and short; perforated anteriorly by a small median opening (fig. 79). There are 34 vertebrae, and 6 branchiostegals.

There is no externally apparent sexual dimorphism.

This is a monotypic genus confined to Japan.

Aspasma minima (Döderlein)

Lepadogaster minimus Döderlein, 1887, p. 270 (Sagami Bay).

Aspasma minima Jordan and Fowler, 1902, p. 414 (Misaki). —Jordan, Tanaka, and Snyder, 1913, p. 378 (Misaki, Sagami, Sigami Bay). —Okada and Matsubara, 1938, p. 378, pl. 89, fig. 1. —Okada, 1938, p. 249 (Honsyu); 1951, p. 39 (Wagu-ōshima, Mie, Japan). —Matsubara, Tanaka, Mori, and Aoyagi, 1949, p. 321, fig. 925 (Boshu, Misaki).

DIAGNOSIS: A large clingfish with a long, slender body and a long caudal peduncle. Dorsal rays 8 (7-9), anal rays 7 (6-9), pectoral rays 22 (21-24) and caudal rays 8 (8-9).

DESCRIPTION: Body slender and only slightly depressed anteriorly, depth 5 (6.9-8.6) in standard length. Caudal peduncle comparatively long, depth 1.4 (1.1-1.6) in its length. Anus usually a little closer to rear margin of disc than to origin of anal fin. Head slender and well depressed, length 3.4 (3.2-3.6) and width 5.2 (4.7-5.8) in standard length. Snout medium, rounded and not protruding in dorsal outline, 3.5 (3.3-3.7) in head. Anterior nostril may have a minute, simple, dermal flap extending from its posterior margin, or this flap may be missing; posterior nostril

usually located just behind or above anterior edge of eye. Eye 1.0 (0.8-1.1) in bony interorbital space and 4.5 (3.9-5.1) in head.

Upper attachment of gill membrane opposite 4th (3-5) pectoral ray. Upper attachment of axial dermal flap opposite 10th (8-12) pectoral ray. Postdorsal-caudal distance in dorsal length 1.0 (0.8-1.4); dorsal-caudal distance forward extends to a point behind pectoral fin. Disc length 5.0 (4.8-5.2) in standard length; no flattened papillae in central portion of disc region A; disc region B with 8 (6-10) rows of flattened papillae across its width; 3 (2-4) rows across width of disc region C. Maximum known size 52.3 mm. standard length.

COLORATION: The available preserved specimens were all without coloration. Döderlein (1887, p. 270), in his original description, mentioned that the life color was reddish. Snyder (1908, p. 184) reported that in two species of *Aspasma* (evidently referring to *A. minima* and *Aspasmichthys ciconiae*) the specimens changed from brownish to pinkish yellow in the preservative, while in some individuals pinkish spots and a lateral stripe appeared.

RELATIONSHIP: This species is the only known member of its genus, with no close relatives.

MATERIAL EXAMINED: UMMZ 161997-9; 162001; 162003-4; 162011; 75 specimens from the vicinity of Misaki, Kanagawa, Japan. SU 7607; 22572; 25615; 47224-5; nine, also from Misaki. UMMZ 162009; four, from Boshyu, Chiba, Japan. SU 47667; one, from Kominato, Chiba, Japan. KU (not numbered) one, also from Kominato.

RANGE: Hon shu Island, Japan.

Subfamily DIADEMICHTHYINAE

DIADEMICHTHYIDAE, Whitley, 1950, p. 127.

Gills three; gill membranes attached to isthmus; disc single. There are two genera and five species; they are found from South Africa to the Indo-Pacific.

ARTIFICIAL KEY TO THE GENERA OF DIADEMICHTHYINAE

1a. Snout comparatively short and broad, length 3.1-4.2 in head length; disc small, length 4.9-6.5 in standard length; a row of conical teeth in lower jaw.....*Lepadichthys* (p. 136)

1b. Snout long and narrow, length 1.9-2.3 in head length; disc very small, length 7.9-9.7 in standard length; a row of incisors in lower jaw.....*Diademichthys* (p. 141)

Genus *LEPADICHTHYS* Waite

Figures 42, 69, 71, 80; Map 15

Lepadichthys Waite, 1904, p. 180 (type species *Lepadichthys frenatus* Waite, 1904, by monotypy).

Body slender and moderately depressed anteriorly; head slender with a short, rounded snout, somewhat produced in dorsal outline. Head length 2.7-3.2 and width 4.2-5.4 in standard length. Nostrils on each side well separated and distinctly tubular. Upper lip comparatively narrow, and may

e lightly wider at sides of snout than at front.
. single row of teeth in each jaw. In upper jaw teeth are highly com-
sed with reverse points (fig. 71); none are present at very tip of jaw,
e the premaxillaries fail to meet at this point, but are held together
a cartilaginous bridge. Only small, sharp-pointed conical teeth in
r jaw. Five to 16 rakers present on second gill arch. Edges of gill
branes attached laterally close to pectoral base and well below upper
gin of pectoral fin. No fleshy pad on lower pectoral base.
Dorsal and anal fins comparatively long, attached to caudal; dorsal rays
-'; anal rays 8-15; pectoral rays 25-31; and caudal rays 10-14. Anal ray
pts usually can be taken readily, but the first dorsal and pectoral rays
very small and easily overlooked. Although the external structure of
(fig. 42) is similar to that of *Diademichthys*, it is well differenti-
d from all other Western Pacific genera.
Subopercular element present, and is the terminal bone posteriorly on
of head. It has no spine. Both pelvis and distal postcleithral bones
tinctive in shape (fig. 69). Posterior portion of pelvis is enlarged
articulates directly with the 2 distal postcleithral bones. Anterior
tions of the paired maxillaries perforated by a large median opening
g. 80). There are 34-37 vertebrae, and 6 branchiostegals.
Not enough is known about the life colors for them to be useful for
onomic purposes.
There is no externally apparent sexual dimorphism.
There are four known species, ranging from the Indian Ocean through the
o-Pacific to Japan.

Artificial Key to the Species of *Lepadichthys*[1]

a Dorsal rays 9-10; anal rays 8; upper attachment of gill membrane opposite 12th to 13th pectoral ray; 5 shallow, blunt rakers on second gill arch.....*minor* (p. 137)
b Dorsal rays 12-17; anal rays 10-15; upper attachment of gill memorane opposite 3rd to 9th pectoral ray; 9-16 slender, pointed rakers on second gill arch.
2. Dorsal rays 12-13; anal rays 10; anus closer to rear margin of disc than to origin of anal fin; postdorsal-caudal distance in dorsal length 2.7-2.8.....*coccinotaenia* (p. 138)
2. Dorsal rays 15-17; anal rays 12-15; anus much closer to origin of anal fin than to rear margin of disc; postdorsal-caudal distance in dorsal length 3.4-4.7.
a. Disc small, length 5.3 (4.9-5.8) in standard length.....*frenatus* (p. 139)
b. Disc very small, length 6.2 (6.0-6.5) in standard length.....*sandaracatus* (p. 140)

Lepadichthys minor, new species

Figure 113

pidogaster indicus Weber, 1913, p. 525 (in part; specimen from Muaras Reef only).
plocrepis costatus (*non* Ogilby) Whitley, 1927, p. 304 (New Caledonia).
pidogaster samoensis (*non* Steindachner) Fowler and Silvester, 1922, p. 124 (Pago Pago, Samoa).—Fowler (*non* Steindachner), 1928, p. 447 (Pago Pago, Samoa).
diesocidae, Koumans, 1953, p. 261 (Obi latoe).

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d one to the dorsal ray count if this fin is not dissected.

DIAGNOSIS: A very small *Lepadichthys* with comparatively short dorsal and anal fins. Anus about halfway between origin of anal fin and rear margin of disc, or slightly closer to the latter. Five shallow, blunt rakers on second gill arch. Upper attachment of gill membrane opposite 12 (12-13) pectoral ray. Postdorsal-caudal distance in dorsal length 2.2 (2.0-2.4). Dorsal rays 10 (9-10), anal rays 8, pectoral rays 28 (27-29), and caudal rays 12.

DESCRIPTION: Body slender and well depressed anteriorly, depth 6.4 in standard length. Caudal peduncle short, its depth 0.8 (0.8-0.9) in its length. Head narrow and depressed, length 2.8 (2.7-3.0) and width 4.4 (4.3-4.5) in standard length. Snout in dorsal outline short and rounded, 3.9 (3.7-4.2) in head. Anterior nostril with a minute, simple, dermal flap extending from its posterior margin; posterior nostril located just behind anterior edge of eye. Eye 0.7 (0.6-0.7) in bony interorbital space and 3.7 (3.4-3.9) in head.

Upper attachment of axial dermal flap opposite 11th (10-12) pectoral ray. Dorsal-caudal distance forward extends to a point behind distal end of pectoral fin. Disc small, length 5.1 (5.0-5.3) in standard length; disc region A with 3 rows of flattened papillae across its width; disc region B with 5 rows across its width.

COLORATION: Fortunately, Koumans (1953, p. 261) described the coloration in his report on the Snellius Expedition specimen: "It is in spirits dark purple, snout a little lighter, belly and throat whitish. A number of white lines on head and body: a median one from tip of snout over back to base of dorsal fin. On each side a more narrow line from tip of snout through upper part of eye back to upper part of caudal fin. On lower side on each side from symphysis of lower jaw a narrow line along lower margin of eye to anal fin."

RELATIONSHIP: This species is very distinct in several respects. It is not close to any of the other known species, and could conceivably be separated from them at the subgeneric level. It has been unrecognized until now probably only because of its small size.

HOLOTYPE: In the Amsterdam Museum (not numbered); 16.7 mm. in standard length, taken by the *Siboga* Expedition from station 91 at Muaras Reef, Celebes Sea. The exact date of capture is not known although it was in 1899 or 1900, since the work of the expedition was accomplished within those two years.

PARATYPES: Australian Museum number 1A832; one specimen, 19.5 mm. in standard length, from Ringdove Bay, Epi, New Hebrides (no collector's name or date available). ANSP 51054-55; two, 21.8 mm. and 18.9 mm. in standard length, taken at Pago Pago, Samoa, during the Carnegie Samoa Expedition in 1917. The collector was Captain C. F. Silvester. LM (not numbered); one, 13.5 mm. in standard length, from Obi latoe in the northern part of the Ceram Sea. It was taken by the Snellius Expedition from a "shore and reef" station on April 23-27, 1930.

REMARKS: The specimen selected as the holotype is one of the four syntypes of *Crepidogaster indicus* Weber. For remarks on these specimens, see under *Pherallodus indicus*, above (p. 45).

DERIVATION OF NAME: The name is from the Latin *minor*, smaller.

Lepadichthys coccinotaenia Regan

Lepadichthys coccinotaenia Regan, 1921, p. 2 (Durban, South Africa).—Barnard, 1927, p. 424 (Natal coast).—Smith, 1949, p. 384, pl. 87, fig. 1088 (tide-pools of Natal).

DIAGNOSIS: A *Lepadichthys* with dorsal and anal fins of medium length.

s closer to rear margin of disc than to origin of anal fin. Sixteen row, pointed rakers on second gill arch. Upper attachment of gill mem- ne opposite 8th or 9th pectoral ray. Postdorsal-caudal distance in dor- length 2.8 (2.7-2.8). Dorsal rays 12 or 13, anal rays 10, pectoral s 28, and caudal rays 11 (10-12).

DESCRIPTION: Body slender and compressed posteriorly, depth 6.0 (5.8-) in standard length. Caudal peduncle short, its depth 0.7 (0.7-0.8) in length. Head narrow and moderately depressed, length 2.8 (2.7-2.9) and th 4.6 (4.4-4.7) in standard length. Snout in dorsal outline medium and nded, 3.3 (3.0-3.4) in head. Anterior nostril with a minute, simple, mal flap extending from its posterior margin; posterior nostril above or t behind anterior edge of eye. Eye 0.8 in bony interorbital space and (4.4-4.5) in head.

Upper attachment of axial dermal flap opposite 13th (12-14) pectoral . Dorsal-caudal distance forward extends to a point behind distal end pectoral fin. Disc small, length 5.5 (5.4-5.5) in standard length; disc ion A with 4 rows of flattened papillae across its width; disc region B h 6 rows across its width. Maximum known size 33.0 mm. standard length.

COLORATION: No coloration evident in alcohol specimens. A plate show- the life colors has been published by Smith (1949, pl. 87, fig. 1088). s shows the body to be greenish with a dark red margin on the upper lip a streak of the same color through the eye.

RELATIONSHIP: This species is closer to *L. frenatus* than to any other ber of the genus.

MATERIAL EXAMINED: BM 1920.7.23.47; one specimen (holotype of *L. coccin- enia*), from Durban, Natal, South Africa. SU 47679-80; two, from Moçam- que (Mozambique) Island, East Africa.

RANGE: Durban, Natal, South Africa, to Mozambique Island, East Africa.

Lepadichthys frenatus Waite

adogaster sp. Kner, 1868, p. 347 (Kanathia, Fiji Islands).
adichthys frenatus Waite, 1904, p. 180, pl. 24, fig. 2 (Lord Howe Island).—McCulloch, 1929, p. 360 (Queensland; Lord Howe Island).
asma misakia Tanaka, 1908, p. 22 (Misaki, Japan).—Jordan, Tanaka, and Snyder, 1913, p. 378 (Misaki, Sagami).—Okada, 1938, p. 249 (Misaki and Bosyu, Honsyu, Japan).—Matsubara, Tanaka, Mori, and Aoyagi, 1949, p. 320, fig. 924 (Boshu, Misaki).

DIAGNOSIS: A *Lepadichthys* with long dorsal and anal fins, and the anus ch closer to origin of anal fin than to rear margin of disc. Twelve (10-) slender, pointed rakers on second gill arch. Upper attachment of gill mbrane opposite 6th (3-8) pectoral ray. Postdorsal-caudal distance in rsal length 3.9 (3.5-4.7). Dorsal rays 16 (15-17), anal rays 14 (12-15), ctoral rays 28 (25-31), and caudal rays 11 (10-14).

DESCRIPTION: Body slender and compressed posteriorly, depth 6.8 (6.2- 3) in standard length. Caudal peduncle short, its depth 0.7 (0.7-0.8) in s length. Head narrow and moderately depressed, length 2.9 (2.8-3.2) and dth 4.7 (4.2-5.4) in standard length. Snout in dorsal outline medium and unded, 3.3 (3.1-3.4) in head. Anterior nostril may have either a minute, mple, dermal flap extending from its posterior margin, or no flap at all; sterior nostril located above or just behind anterior edge of eye. Eye 8 (0.6-1.0) in bony interorbital space and 4.4 (4.0-5.0) in head.

Upper attachment of axial dermal flap opposite 13th (12-14) pectoral y. Dorsal-caudal distance forward extends to an area between middle of ctoral fin and a point just in front of upper pectoral base. Disc small, ngth 5.3 (4.9-5.8) in standard length; disc region A with 2 (0-6) rows of

flattened papillae across its width; disc region B with 7 (6-9) rows across its width. Maximum known size 52.5 mm. standard length.

COLORATION: Alcohol specimens with no coloration. Waite (1904, p. 181) gives the colors of the freshly preserved holotype as follows: "When preserved the general colour is pinkish yellow. The edge of the upper lip is bright scarlet, the colour continued as a streak which passes backward through the eye towards the upper margin of the opercle. Fins colourless." A natural color photograph of a Japanese specimen has been published by Okada, Uchida, and Matsubara (1935, pl. 148). This shows the body to be a reddish yellow with the fins and ventral surface of the disc somewhat lighter. There is a suggestion of a slightly darker bar through the eye.

RELATIONSHIP: Very close to *L. sandaracatus*. The differences may be only subspecific.

MATERIAL EXAMINED: AuM I3129; one specimen (holotype of *L. frenatus*), from Lord Howe Island. BM 1933.1.25.216-17; two, from the Capricorn Group, North Queensland, Australia. AuM 1B2234; one, from Anse Vata, Nouméa, New Caledonia. AuM 1A4161; one, from Vila Harbour, New Hebrides. USNM 132766; one, from Kimmu Wan Bay, on the east coast of Okinawa. UMMZ 162005; one, from Hamada, Shimane, Japan. UMMZ 162008; one, from Ezumi, Shimane, Japan, UMMZ 162003-4; nine, from Misaki, Kanagawa, Japan. SU 22569; 47681; two, from Misaki, Kanagawa, Japan. SU 47726-7; seven, from Kominato, Chiba, Japan.

RANGE: Lord Howe Island and North Queensland, Australia, to Sagami Nada, Kanagawa, Japan.

Lepadichthys sandaracatus Whitley

Lepadichthys sandaracatus Whitley, 1943, p. 140 (Useless Inlet, Shark's Bay, Western Australia); 1948, p. 28 (Western Australia).

DIAGNOSIS: A *Lepadichthys* with a very small disc, its length 6.2 (6.0-6.5) in standard length. Dorsal and anal fins long, and anus much closer to origin of anal fin than to rear margin of disc. Nine slender, pointed rakers on second gill arch. Upper attachment of gill membrane opposite 5th (4-7) pectoral ray. Postdorsal-caudal distance in dorsal length 3.6 (3.4-3.8). Dorsal rays 15 or 16, anal rays 12 or 13, pectoral rays 27 or 28, and caudal rays 10.

DESCRIPTION: Body slender and compressed posteriorly, depth 6.8 (6.2-7.5) in standard length. Caudal peduncle short, its depth 0.8 in its length. Head narrow and moderately depressed, length 2.9 (2.9-3.0) and width 4.8 (4.6-5.0) in standard length. Snout in dorsal outline medium and rounded, 3.3 (3.2-3.4) in head. Anterior nostril with a minute, simple, dermal flap extending from its posterior margin; posterior nostril just behind anterior edge of eye. Eye 0.8 (0.8-0.9) in bony interorbital space and 4.2 (4.1-4.2) in head.

Upper attachment of axial dermal flap opposite 13th (12-15) pectoral ray. Dorsal-caudal distance forward extends to an area between midpoint and proximal one-third of pectoral fin. Disc region A with 2 rows of flattened papillae across its width; disc region B with 5 rows across its width. Maximum known size 35.0 mm. standard length.

COLORATION: In alcohol, color is either a translucent yellow or carmine. Life colors are unknown.

RELATIONSHIP: Very close to *L. frenatus*. Further collections in other areas may possibly show that only subspecific differences exist.

MATERIAL EXAMINED: AuM 1B307; one specimen (holotype of *L. sandaracatus*), from Shark's Bay, Western Australia. AuM 1B308; one (paratype of *L. sandaracatus*), from the above locality.

RANGE: Shark's Bay, North West Division, Western Australia.

Genus *DIADEMICHTHYS* Pfaff

Figures 70, 71, Map 15

emichthys Pfaff, 1942 (May), p. 413 (type species *Diademichthys dever-sor* Pfaff, 1942, by original designation).
nichthys Herre, 1942a (August), p. 120 (type species *Coronichthys ornata* Herre, 1942, by original designation).

Body slender and well compressed posteriorly, rounded and only slightly ressed anteriorly. Head narrow, with a long, slender spatulate snout. h small and inferior; upper lip small and indistinct. Nostrils on each widely separated and tubular.

Both jaws with a single row of incisors, those at the very front narrow trifid, becoming broad with pointed reverse tips (fig. 71) along the s. Ten narrow, sharp rakers present on the second gill arch. Edges of membranes attached well in front of pectoral base and considerably be-upper origin of pectoral fin. No fleshy swelling or pad on lowest part pectoral base.

Dorsal and anal fins long and attached to the caudal. Rays in median s may be counted easily, but, as in many other clingfishes, the first toral ray is very small, and likely to be overlooked. Disc very small rounded; the pattern of flattened papillae on ventral surface similar that found in *Lepadichthys* (fig. 42), but distinct from all other West-Pacific genera.

Subopercular element present and forms the terminal bone posteriorly on e of head. It has no spine. Pelvis highly characteristic in shape from entral view (fig. 70). Distal postcleithral bones notched to fit close-with the enlarged posterior end of pelvis. Premaxillaries extremely ngate and are perforated anteriorly by a large median opening (fig. 81). re are 37 vertebrae, and 6 branchiostegals.

A remarkable sexual dimorphism is evident in the development of the ut, that of the female being considerably narrower and more elongate. addition, the head of the female is more slender, and the depth of the y is less than that of the male. These differences are well described figured by Pfaff (1942, pp. 414-415, pl. 3). It may be added that the genital papilla of the male is noticeably longer and broader than that the female.

This is a monotypic genus found in the Indo-Pacific, the Indian Ocean, the Philippines. It is found is association with the echinoid *Diadema*, ng whose poisonous spines it lives.

Pfaff's description of *Diademichthys* appeared shortly before Herre's cription of *Coronichthys*.

Diademichthys lineatus (Sauvage)

Figures 81, 114

oidogaster lineatum Sauvage, 1883, p. 158 (New Caledonia).—Fowler, 1928, p. 447 (New Caledonia).
demichthys deversor Pfaff, 1942, p. 413, pl. 3, figs. 1-3 (Java Sea and Mauritius).
onichthys ornata Herre, 1942a, p. 120, fig. 1 (Coron, Philippines).
demichthys lineatus Whitley, 1950, p. 127, fig.; 1951, p. 404, fig. 10 (Anse Vata, Nouméa, New Caledonia).

DIAGNOSIS: A very striking little fish which is unmistakable because of

its long, slender spatulate snout, longer in the female than in the male. Disc very small, its length 8.7 (7.9-9.7) in standard length. Dorsal rays 14 (13-15), anal rays 13 (12-14), pectoral rays 26 (25-26), and caudal rays 13 (12-14).

DESCRIPTION: Body slender and compressed posteriorly, depth in males 10.3 (9.7-10.7), in females 11.8 (11.2-12.9), both in standard length. Caudal peduncle short, its depth 0.7 (0.6-0.8) in its length. Anus much closer to origin of anal fin than to rear margin of disc. Head narrow and well depressed, length in males 3.0 (2.8-3.1), in females 2.5 (2.4-2.5), and width 8.0 (7.6-8.4), all in standard length. Snout in males long, 2.. (2.2-2.3) in head; snout in females longer, 1.9 (1.9-2.0) in head. Anteri or nostril a simple structure without a dermal flap on margin; posterio nostril in front of anterior edge of eye. Eye in males 0.6 (0.4-0.7) i bony interorbital space, and in females 0.3; eye 5.4 (5.0-5.9) in hea (both sexes).

Upper attachment of gill membrane opposite 9th (8-10) pectoral ray; upper attachment of axial dermal flap opposite 14th (12-15) pectoral ray. Dorsal-caudal distance forward extends to a point well behind pectoral fin. postdorsal-caudal distance in dorsal length 3.6 (3.2-3.8). Disc region A with 4 rows of flattened papillae across its width; disc region B with 5 (4-6) rows across its width. Maximum known size 46.2 mm. standard length.

COLORATION: The specimens available had all been in alcohol for a numbe of years, and were almost completely colorless. Fortunately, Pfaff (1942, p. 415) has given good descriptions of both live and freshly preserved specimens, as follows: "Color [of male holotype] in alcohol reddish, event ually turning to reddish yellow or pale yellow, the original red color only being kept as a horizontal streak through the eye. Four clear white lines adorn the body. A dorsal line runs from the tip of the snout to the origi of the dorsal, from which point it is continued for some distance at the base of the fin. A side-line originates a short distance before the eye, runs through the upper part of the eye itself, continues along the sides a little nearer the dorsal than the ventral line, and terminates in a smal white spot at the base of the caudal fin. A white ventral line originates just behind the disc and continues to the base of the anal fin. Fins without markings except the caudal, which has a faint yellowish, crescentic mark.

"Color in life was black, with bright white lines, the black color immediately turning to red when the fish is put into alcohol. The color in the allotype [female] nearly as in the males. The white side-line, however, stops at a short distance before the root of the caudal, which place carries a little white, crescentic spot."

RELATIONSHIP: This species is easily separated from all other clingfishes and deserves to be relegated to its own genus.

MATERIAL EXAMINED: MHNP 89-902; one specimen (holotype of *Crepidogaster lineatum*), from New Caledonia. UMMZ 162000; six, from Djakarta Bay, Java KZM 18.10.1941; one (paratype of *D. deversor*), from Onrust, Java Sea. SU 39861; one, from Bungau, Sulu Province, Philippine Islands. SU 36533; one (holotype of *Coronichthys ornata*), from Coron, Busuanga, Philippines.

RANGE: New Caledonia west to Mauritius in the Indian Ocean, and north to the Java Sea and Busuanga Island, Philippines.

REMARKS: From the account of Pfaff, this species appears to be closely associated ecologically with the sea-urchin *Diadema savignyi* and possibly also with *D. setosum*.

EVOLUTION OF THE GOBIESOCIDAE

Dendrograms 1-5

his analysis of the major evolutionary trends in the Gobiesocidae is d on several important propositions, which collectively form a premise wing certain conclusions to be drawn.

. *A reduction in the number of gills accompanies specialization.* This xiomatic as far as fish evolution in general is concerned, and probably be relied upon in the present instance.

2. *Reduction of the gill openings is a progressive occurrence.* Such a ction in the relative size of the gill opening is often considered a ure of evolutionary specialization. Whether it should be so considered his particular group is problematical. However, since increased gill- brane attachment is usually accompanied by one or more other advanced racters, it appears that this statement is sound.

3. *The pressure of natural selection favors the development of a single ier than a double adhesive disc.* This proposition, although hypothet- l, seems logical It is based on the assumption that a single disc ld be mechanically more efficient than a double structure, where the sence of an extra ridge through the center would interfere with suction.

4. *The primitive dental pattern consists of patches of undifferentiated ical teeth in each jaw.* The gradual progress from teeth of this type ough a great variety of specializations has been followed in many verte- te groups. This is one of the most interesting features of clingfish lution, such dental changes being of great systematic importance through- the group.

With the foregoing propositions in mind, it is possible to place the families in their proper phylogenetic relationship.

The subfamily Trachelochisminae represents the most primitive known emblage in the family. There are three and one-half gills, the gill brane is free from the isthmus, and the disc is double. In addition, of the species have a primitive dental arrangement consisting of patches ndifferentiated, conical teeth.

Next is the monotypic subfamily Haplocylicinae, differentiated from the chelochisminae by the single type disc. The highly characteristic phology indicates a considerable period of divergent evolution rather a direct branching from the Trachelochisminae.

The Lepadogastrinae are more likely derivatives of the Trachelochisminae, except that the gill membranes are attached at the isthmus, they are ier similar. With the exception of one genus, *Apletodon*, the primitive dition is still retained.

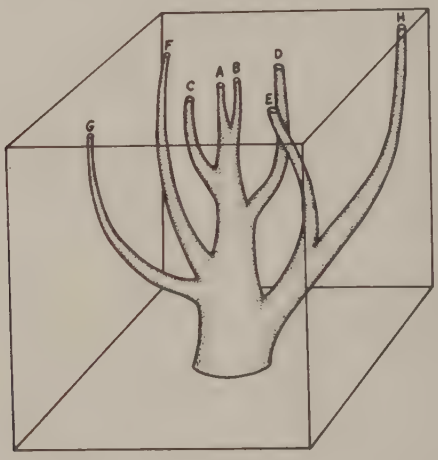
The monotypic subfamily Chorisochisminae presents a problem, because iously it did not arise directly from the Lepadogastrinae. Both the eral external characteristics and the details of the bony structure gest a divergence from the more primitive stock before the origin of the dogastrinae.

The loss of the demibranch from the fourth gill arch represents an rtant step forward. There is little doubt that the Diplocrepinae are e or less direct derivatives of the Trachelochisminae. There are a t many similarities between the most primitive genus in the Diplocrepi- *Diplocrepis*, and the genus *Creocele* of the Trachelochisminae. There- e, I consider the former subfamily a product of the main evolutionary nk which leads directly to the most advanced groups.

From the evidence at hand, it seems clear that the subfamily Diplocrepi- then gave rise to two or more branches: one, the Gobiesocinae, at an

early stage; the other, the Aspasminae, through the most advanced dipl crepin genus, *Pherallodus*. The subfamily Gobiesocinae, characterized by single disc, is closer to *Diplocrepis* than to any other Old World genu and probably diverged at this level.

The remainder of the phylogenetic picture is laid out in a beautifu almost orthogenetic pattern as one proceeds from the most specialized ge in the Diplocrepinae, *Pherallodus*, over the subfamily line to *Aspasma* the Aspasminae. In the latter group the gill membrane has become attach to the isthmus. The genus *Aspasmichthys* then leads directly to *Lepadicht* in the Diademichthyinae, where the double disc has coalesced into a sing structure. The progressive changes from *Pherallodus* to *Aspasma* to *Aspa michthys* to *Lepadichthys* (through the subfamily levels) can be followed examining the outline drawings of the pelvis and distal postcleithral bo (figs. 53, 68, 67, 69), the premaxillaries (figs. 77, 78, 79, 80), and t teeth (text and fig. 71).



Dendrogram 1. Illustrating the evolution of the subfamilies of t Gobiesocidae. A. Diademichthyinae. B. Aspasminae. C. Gobiesocinae. Diplocrepinae. E. Lepadogastrinae. F. Chorisochisminae. G. Haplocylic nae. H. Trachelochisminae.

A hypothetical family tree of the Gobiesocidae, based on the above o servations, is presented graphically in Dendrogram 1 in the hope that will aid in clarifying these relationships.

THE SUBFAMILIES

The problem of phylogenetic separation is considerably more difficu within the subfamily units than with the subfamilies as a whole. In co sidering clingfish evolution however, certain trends seem to provide usef criteria for the evaluation of changes within the minor groups.

There is a noticeable tendency toward a reduction in size and an alter tion of the body shape from a broad, well depressed type to a narrowe less depressed, and frequently more attenuate one. The pelvis chang from a heavy, comparatively simple structure to a lighter more complex fo

ch may become modified posteriorly for direct articulation with the two tal postcleithral bones (figs. 43-70). As noted in the family dis- sion, the trend toward dental differentiation is marked and provides a y useful indicator of specialization. Accompanying the above changes is eduction or loss of the fleshy pectoral pad and the subopercular spine. some species the entire subopercular element is wanting. Also, the lips ome less broad and fleshy, and the disc smaller.

The evolution within each subfamily (with the exception of the mono- ic Haplocylicinae and Chorisochisminae) is discussed under subfamily dings below. Comments on evolution within some of the larger genera ompany the generic descriptions in the systematic section.

TRACHELOCHISMINAE

The monotypic genus *Creocele* is the most primitive known clingfish. It characterized by the presence of a strong subopercular spine, a well- eloped, fleshy pectoral pad, and a much larger disc and total body size n is found in the other genera of the subfamily. In addition, the pel- is heavier and more simplified than in three of the other four genera ere was no opportunity to examine the pelvis of *Gastrocymba*). Although ide gap exists between *Creocele* and *Trachelochismus*, the latter genus be considered the next surviving stage in the group. As can be seen by outline drawings (figs. 43 and 46), the shape of the pelvis changes siderably. Also, *Trachelochismus* lacks the subopercular spine and the toral pad. Directly above the latter is the closely related *Conidens*, ch shows still further pelvic modification (fig. 45), and also a reduc- n in the size of the lips.

The genus *Dellichthys* is probably an offshoot of the *Creocele-Trachelo- smus-Conidens* line. It is closest to *Trachelochismus* but has lost the opercular bone, has many more gill rakers, and an elongate, flattened ut. There are also differences in the shape of the distal postcleithral es (figs. 44 and 46).

Gastrocymba is not only the most specialized genus in the subfami- but is unique in several respects. It is the most attenuate of all ngfishes, with by far the highest vertebral count in the entire family—

The disc is exceptionally small (when its length is divided into the ndard length), and the caudal peduncle is extremely long and narrow. arently the ancestral forms of this genus split off from the *Creocele- chelochismus* line at a very early stage and underwent a long period of ergent evolution.

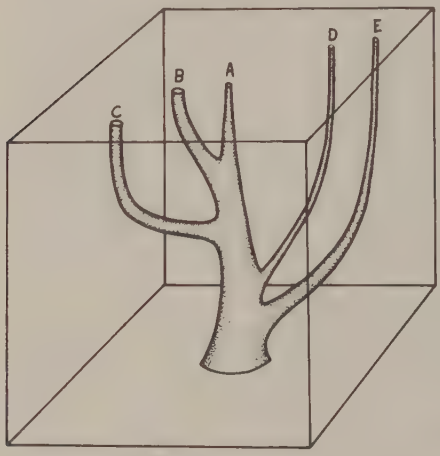
The progress within the subfamily Trachelochisminae is depicted graphic- y in Dendrogram 2.

LEPADOGASTRINAE

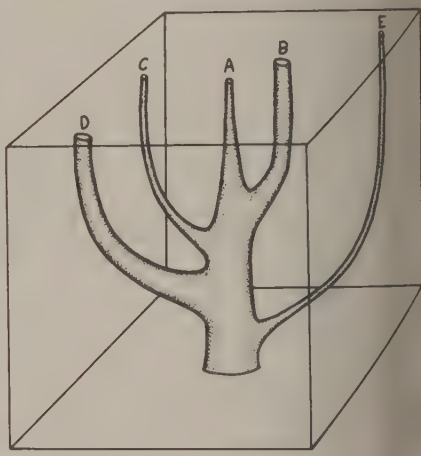
Lepadogaster is the most primitive genus in this subfamily. It attains largest size and has the least modified pelvis (fig. 50). It also sesses many more features reminiscent of the Trachelochisminae (espe- lly the genera *Trachelochismus* and *Dellichthys*) than do other members of s subfamily. From *Lepadogaster* the line leads almost directly to *Diple- aster*, marked by such changes as a considerable reduction in the number dorsal and anal rays, a shortening of the premaxillaries, and a shifting the maxillaries to a more forward position (figs. 76 and 74). The next p is to the genus *Apletodon*. Although superficially much like *Dipleco- ter*, *Apletodon*, as its name implies, presents a notable evolutionary ance because of the specialization of its teeth; beside the standard

conical shape, there are well-defined incisors and canines. There is a reduction in the number of gill rakers, and the anal region bears numerous papillae.

The genera *Gouania* and *Opeatogenys* are highly modified, suggesting long independence from the *Lepadogaster-Diplecogaster-Apletodon* line. The rudimentary dorsal and anal fins of *Gouania* have no parallel in the entire family. The median fin-ray counts together with other anatomical evidence make it probable that the branching took place at or before that of *Lepadogaster*. As to *Opeatogenys*, the tendency for a reduction in the number of dorsal and anal fin rays (shown to occur in the transition from *Lepadogaster* to *Diplecogaster*) is continued, suggesting that the split occurred near the *Diplecogaster* level. The pectoral fin-ray count is also reduced. Most remarkable, however, is the strong subopercular spine, unique in the subfamily.



Dendrogram 2. Illustrating the evolution of the subfamily Trachelochisminae. A. *Dellichthys*. B. *Conidens*. C. *Trachelochismus*. D. *Gastrocymba*. E. *Creocele*.



Dendrogram 3. Illustrating the evolution of the subfamily Lepadogastrinae. A. *Apletodon*. B. *Diplecogaster*. C. *Opeatogenys*. D. *Lepadogaster*. E. *Gouania*.

The direction of evolution in the Lepadogastrinae is shown graphically in Dendrogram 3.

DIPLOCREPINAE

Diplocrepis is undoubtedly the most primitive genus in the subfamily. It has a large, broad body, a well-developed pectoral pad, a relatively simple pelvic structure (fig. 52), and a strong opercular spine. Particularly in its osteology, *Diplocrepis* shows a definite similarity to *Creocele* of the most primitive subfamily, the Trachelochisminae. *Cochleoceps* is derived either directly from *Diplocrepis* or from a line close to it. The opercular spine and the fleshy pectoral pad have been lost, and the head and body are more slender.

Aspasmogaster represents a further step toward a more slender body and a smaller head and disc. Also, the pattern of flattened papillae on the

tral surface of the disc (fig. 28) shows a marked change from that of *hleoceps* (fig. 29). There are more dorsal and anal fin rays, although s increase is not continued through the following genera. In *Parvicre-* the reduction of body width, head, and disc size is carried farther. attenuation of the body increases; there are 32 vertebrae in *Aspasmo-ter* and 37 in *Parvicrepis*.

In *Gastrocyathus* and *Gastroscyphus* the body has become very long and row, with 42 or 43 vertebrae. The disc is even smaller, and has become e or less elongate. Of the two genera, *Gastrocyathus* is the more spe-lized because of its small, inferior mouth and more highly modified bony c supports. The shape of the pelvis and the distal postcleithral bones unique (fig. 55). No other clingfish genus has the supplementary ification at the posterior end of each of the two distal postcleithral es.

It is difficult to decide exactly where *Pherallodus* should be placed. hough the pelvis is considerably shorter, its general structure is ilar to that of *Aspasmogaster* (figs. 53 and 57). The external features the disc are not unlike those of *Aspasmogaster* (figs. 24 and 28), and body shape is much the same. However, the presence of incisors in *rallodus* would suggest an earlier derivation, since *Aspasmogaster* and the following genera have conical teeth.

Evolution in the Diplocrepinae has been fairly straight-forward except the early dichotomy which gave rise to *Pherallodus*.

GOBIESOCINAE

Sicyases is probably the most primitive genus of the Gobiesocinae. st, and perhaps most significant, the pelvic girdle is a relatively ple, heart-shaped structure (fig. 58), without the modifications found the other genera. Also, and peculiar to *Sicyases*, a small patch of th, apparently arising from the palatine bone, is present on each side the upper jaw. Furthermore, the gill rakers are best developed and most erous in this genus. Finally, the individuals, at least in one of the species, *S. sanguineus*, attain the largest size of any American cling-h.

If *Sicyases* is the most primitive gobiesocin genus, *Arcos* must be next the phylogenetic line. It has more characters in common with *Sicyases* n do any of the other genera, but shows definite advancement in several ers. The structure of the pelvis is more complicated (figs. 63 and 58), palatine teeth are lost, the gill rakers have become greatly reduced th in number and size), and there are fewer vertebrae.

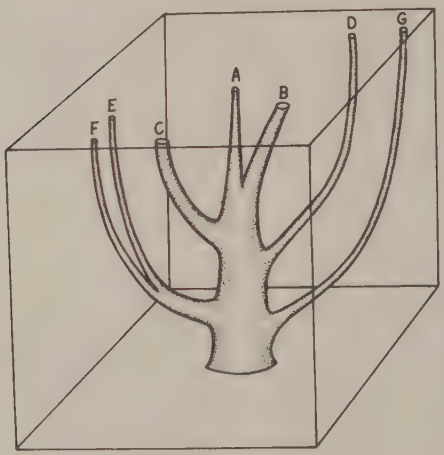
Acyrtus is much closer to *Arcos* than it is to any other group. It dif-s from the latter principally in a modification of the distal post-ithral bones (figs. 65 and 63), a sharp reduction in the size of the shy pad on the pectoral base, in the possession of gill membranes with a ser lateral attachment to the pectoral base, and in a noticeable reduc-n in size.

Eckloniaichthys, *Acyrtops*, and *Rimicola* are closely related to each er, but are very different from the other genera; they represent an lutionary branch considerably removed from the *Sicyases-Arcos-Acyrtus* e. The ancestral forms of the first three genera probably diverged from latter line at an early stage, possibly before the *Arcos* level was ained. Characters common to the first three include very small adhesive cs, peculiar both in the internal (figs. 60-62) and external (figs. 34) anatomy; a very narrow upper lip; and greatly reduced lower rays of pectoral fin. *Eckloniaichthys* is the most advanced of the three. The

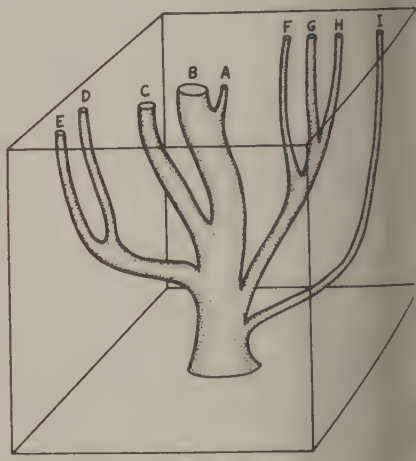
teeth of the upper jaw are reduced to a single row; there are fewer gill rakers; and the bony disc supports are considerably modified (fig. 60).

Tomicodon seems most closely related to *Acyrtus*, although it represents a considerable advance. Although the osteology of the disc (fig. 59) shows little change from that of *Acyrtus* (fig. 65), there are a number of external differences in body form. The head is shorter and narrower; the disc is smaller; the dermal flap on the anterior nostril is more simplified; and there remains but a single row of teeth in each jaw. Also, the external sexual dimorphism, apparent in the *Sicyases-Arcos-Acyrtus* line, is not found in *Tomicodon*.

Gobiesox and *Pherallodiscus* are close to each other, and closer to *Arcos* than to any other genera in the subfamily Gobiesocinae. In the more primitive species of *Gobiesox*, the dentition, the shape of the fleshy pectoral pad, and the general body morphology resemble those characters in *Arcos*.



Dendrogram 4. Illustrating the evolution of the subfamily Diplocrepinae. A. *Parvicrepis*. B. *Aspasmogaster*. C. *Pherallodus*. D. *Cochleoceps*. E. *Gastrocyathus*. F. *Gastroscyphus*. G. *Diplocrepis*.



Dendrogram 5. Illustrating the evolution of the subfamily Gobiesocinae. A. *Pherallodiscus*. B. *Gobiesox*. C. *Tomicodon*. D. *Acyrtus*. E. *Arcos*. F. *Eckloniaichthys*. G. *Rimicola*. H. *Acyrtops*. I. *Sicyases*.

However, in *Gobiesox* the disc is distinctive, especially in its soft anatomy (fig. 36); the structure of the dermal flap on the anterior nostril is very different from that found in *Arcos*; and the eyes are considerably smaller. Apparently the phylogenetic gap between *Gobiesox* and *Arcos* is a comparatively wide one.

The affinity between *Pherallodiscus* and *Gobiesox* is close. There is a remarkable similarity in the shape of the bony disc supports (figs. 64 and 66); in the nature of the anterior nostril flap; in the dentition of the upper jaw; in the number of vertebrae; and in the general body appearance. On the other hand, the external disc shape (fig. 38) of *Pherallodiscus* is characteristic; the dentition of the lower jaw differs; and in both species there is an external sexual dimorphism (fig. 13). These differences are sufficient to differentiate *Pherallodiscus* as a genus distinct from, although closely related to, *Gobiesox*.

The interrelationships of the genera of the Gobiesocinae are represented graphically in Dendrogram 5.

ASPASMINAE

As mentioned above (p. 144) in the discussion of the family Gobiesocidae e genera *Aspasma* and *Aspasmichthys* seem to be directly on the evolution- y line which extends to the Diademichthyinae. In *Aspasma* the premaxil- ries are short with a small opening between them (fig. 79), while in *pasmichthys* they are longer and the fenestra larger (fig. 78). The pel- s is shorter and the postcleithral bones fit closely into the posterior d in *Aspasmichthys* (figs. 67 and 68), and there is an increase in the mber of dorsal and anal fin rays over that found in *Aspasma*.

The monotypic genus *Liobranchia* differs greatly from the *Aspasma-Aspas- chthys* line, and must have undergone a considerable separate evolution, indicated by its several unique features: the large, vertical ridges on e sides of the body; the compressed body; and the small rounded head. e external appearance of the disc is also unique (fig. 39), and, perhaps st peculiar of all, the gill rakers have entirely disappeared. It seems kely that the ancestor of this interesting genus began separate evolution en before the *Aspasma* stage was reached.

DIADEMICHTHYINAE

The most advanced subfamily of the Gobiesocidae, the Diademichthyinae, composed of two fairly closely related genera, *Lepadichthys* and *Diadem- hthys*. The latter is the more specialized, with a narrower head, an tremely elongate snout (figs. 81 and 80), and a smaller disc. An inter- ting form of sexual dimorphism appears in *Diademichthys*; the head of the male is narrower and the snout longer than in the males (fig. 81). While ese differences are obviously generic, there is no reason to carry the paration to the family level, as has been proposed by Whitley (1950, p. 7). The premaxillaries of *Diademichthys* (fig. 81) are merely an elongate rsion of those of *Lepadichthys* (fig. 80), and, while there is some change the shape of the pelvis (figs. 70 and 69), the same basic structure is early evident in both. Aside from the elongate snout, the general body ape and the size and placement of the fins are almost identical in the o genera.

DISTRIBUTION

Maps 1-15

The Family

Although the clingfishes are not a numerous group (a total of 93 known ecies), they are very widespread, being found all over the world in tropic d temperate waters. It was surprising to discover that a comparatively rge number (43 species) were concentrated along the shores of the Eastern cific. However, these all belong to six genera included in a single sub- mily. In contrast, the Western Pacific plus the Indian Ocean has only species but these reveal a long evolutionary history since they belong 21 of the 33 known genera and all eight of the subfamilies. It was in- resting to find that the Eastern and Western Atlantic were identical in at each area supported 11 species included in five genera and one sub- mily.

It can be said that the New Zealand waters have held the key to the

solution of the principal steps in the evolution and distribution of the entire family. No less than seven genera and eight species are found in this area, all of which are endemic relicts,[1] undoubtedly the remnants of a number of successive invasions which took place over a long period of time.

The origin and operation of a secondary region of evolution and dispersal in the Eastern Pacific and the part played by the clingfishes in the "complementary" fresh-water fish fauna of that region are discussed under the subfamily Gobiesocinae. The details of distribution along the various coast lines are taken up under the particular subfamily involved.

TRACHELOCHISMINAE

Maps 1, 2

The remarkable survival of *Creocele*, the most primitive clingfish genus, in Tasmanian waters (map 1) has been fortunate. The complete absence of fossil material has made it necessary to depend upon such existing relicts for information concerning the distributional and evolutionary history of the family. The shallow waters of Tasmania are evidently cold enough to prevent effective penetration and competition from the several more advanced species common in Australia.

Of the four other genera in this subfamily, three are also relicts and are endemic to New Zealand (map 2). There is little doubt that *Trachelochismus* and *Dellichthys* or an immediate, perhaps common, ancestor was very widespread at one time. As has been noted in the discussion on evolution, *Lepadogaster* is very close to these two genera, indicating that one of them (or its ancestor) must have extended to the Eastern Atlantic. The presence of *Trachelochismus* and *Dellichthys* in New Zealand represents another very fortunate occurrence of relict survival.

The distribution of the genus *Conidens* is quite puzzling (map 1), for *C. laticephalus* is evidently confined to Southern Japan, but *C. samoensis* is found in the tropical Indo-Pacific. The survival of *C. samoensis* as a hanging relict probably indicates that it does not compete directly with the more advanced forms which inhabit the same area. Its size is very small and most likely it has become adapted to a protective type of ecological niche.

HAPLOCYLICINAE

Map 1

This is another New Zealand relict (map 1), a monotypic subfamily which bears comparatively little resemblance to any other known forms.

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[1] In the light of certain recent contributions, I take this opportunity to define my use of the term "relict". Simpson (1953, p. 363) distinguished four different kinds of relicts (numerical, geographic, phylogenetic, and taxonomic) but did not consider another particular kind (hanging) which had been defined by Schmidt (1943, p. 248). In discussing the clingfishes, I have frequently utilized the term relict and, unless it is modified, the reader may assume that I am referring to a unit that is a survivor in a geographic, phylogenetic, and taxonomic sense (in most cases I can't be sure about the numerical part). If the taxon in question does not occur somewhere on the periphery of the range occupied by the family, then the reference "hanging relict" will be used.

LEPADOGASTRINAE

Maps 3, 4, 5

As mentioned above, *Lepadogaster* is very close to two genera (of the achelochismina) which are now confined to New Zealand waters. It is kely that this entire subfamily has evolved from a single precursor which y have been a member of the rich tropical fauna which once extended from e Indo-Pacific into the Northeastern Atlantic. Paleontological studies ve shown that the great Tethys Sea connected the Mediterranean, the In- an Ocean and the Western Pacific (evidently during the whole of the Meso- ic and the Early Tertiary Period). The colder climate of the later rtiary, which wiped out so much of the tropical fish fauna in the Atlan- c, may have eliminated other clingfish species and allowed the *Lepado- ster*-like form to undergo evolutionary radiation in this region (map 3). least, this seems to be the most logical explanation as to why the East- n Atlantic (with the exception of the tip of South Africa) is now occu- ed only by Lepadogastrinae. The fact that the two related primitive nera (see Trachelochisminae, above) have been able to survive in the mperate environment of New Zealand may indicate a possible preadaptation colder temperature.

The statement by Ekman (1953, p. 80) that the Straits of Gibraltar do not rm an important boundary and that the Mediterranean is, therefore, not a stinct faunal unit is supported by a number of zoogeographic studies. is conclusion is upheld to some extent by the pattern of clingfish dis- ibution. Of the six species of Lepadogastrinae which exist in the Medi- rranean, four also extend into the Atlantic, three to the north and one the south. In an earlier work on marine zoogeography Ortmann (1896, 96) designated the Mediterranean a separate subregion of his "Westafri- nische Litoralregion" which, as the name implies, extended south to in- ude a greater part of the West African shore line. In the light of many re recent investigations, the Mediterranean-Atlantic region of Ekman, ich ranges both to the north and to the south of the Straits of Gibraltar, ems to give a much better picture of the faunal relations in this part of e world.

It is of interest to note that the three species of Lepadogastrinae ich range north from the Mediterranean extend considerably further than e western entrance to the English Channel, the point which has been des- nated by Ekman (1953, p. 82) as the northern limit of the Mediterranean- lantic region. *Lepadogaster candollei* reaches half-way up the English ast, *Diplecogaster bimaculata bimaculata* extends all the way to Trond- emsfjord, Norway, and the Faeroe Islands (map 4), and *Apletodon micro- phalus* has been taken at Argyll, Scotland (map 5).

Some clingfishes are found at the offshore islands of the Eastern Atlan- c. A specimen of *Diplecogaster bimaculata bimaculata* from the Faeroe lands failed to show any marked differences from the population which tends south into the Mediterranean. An endemic species of *Lepadogaster*, *zebrina*, is found at Madeira. *Apletodon pellegrini*, a mainland species om the south, has also been reported from this island.

Evidently only a single species has succeeded in reaching the Azores. is is *Diplecogaster bimaculata pectoralis*, a new subspecies described n this work. This deep-water clingfish is found also at the Canaries, e Cape Verde Islands, and Dakar. *Apletodon pellegrini*, the species re- rted from Madeira, is also found at the latter three localities. Another w *Diplecogaster*, *D. ctenocrypta*, is from the Canary Islands but it cannot

be regarded strictly as an island species, since it was taken from deep water, and also because of the proximity of this archipelago to the West African mainland.

With the exception of one species, all of the members of this subfamily are confined to the temperate waters of the North Eastern Atlantic (including the Mediterranean). The exception is *Diplecogaster megalops*, a new species described in this monograph, which was collected in deep water off Durban, Natal, South Africa.

It seems clear that the existence of this south temperate species can be accounted for by the distributional phenomenon of tropical submergence, which has evidently occurred across the West African area in other species of fishes. For example, the northern *Merluccius merluccius* and *Zeus faber* are represented by the very closely allied southern forms *M. capensis* and *Z. capensis*. It is known that the West African tropical fauna is restricted to a considerably thinner surface layer of water than in any other tropical region. *Diplecogaster* is a genus which is typically found in comparatively deep water, so theoretically such a distribution should not be entirely unexpected (all of the specimens of *D. megalops* were taken at depth of from 68 to 120 fathoms).

CHORISOCHISMINAE

Map 6

This is a relict, a monotypic subfamily not closely related to any other known group. It is confined to the southernmost part of Africa (map 6).

DIPLOCREPINAE

Maps 5, 6, 7, 8

Even though this subfamily represents a considerable evolutionary advance, the distribution of the genera is still mainly of a relict type. Three, including the most primitive genus, *Diplocrepis*, are endemic to New Zealand (map 7). Three more, *Cochleoceps*, *Aspasmogaster*, and *Parvicrepis*, are apparently restricted to the comparatively cool waters of the southern Australian area from Tasmania to Lord Howe Island (map 8). As was mentioned in the discussion on evolution, *Cochleoceps* was either derived from *Diplocrepis* or from a line close to it, suggesting that the latter, or a close relative, once had a much wider distribution.

The genus *Pherallodus* is represented by two known species, one (*P. smithi*) a relict in South East Africa and the other (*P. indicus*) ranging widely in the tropical Indo-Pacific (map 6). The problem presented by the latter species is similar to that posed in the case of *Conidens samoensis*: why has a primitive species been able to survive as a hanging relict in an area inhabited by the most advanced members of the family? It can only be surmised that it has become adapted to a type of ecological niche where there is little or no direct competition with its more specialized relatives.

GOBIESOCINAE

Maps 9, 10, 11, 12, 13

With the exception of *Eckloniaichthys*, a monotypic genus of South Afri-

this subfamily is found only in the New World. Here it is represented eight known genera. *Rimicola*, *Pherallodiscus*, and *Sicyases* are confined to the Eastern Pacific (map 9), while *Acyrtops* and *Acyrtus* are restricted to the Western North Atlantic (map 10). *Gobiesox* (map 11), *Tomicon* (map 12), and *Arcos* (map 10) are represented in both areas, with the great majority of species occurring in the Eastern Pacific. Of the 54 known species in the New World only 11 are native to the Atlantic coastal areas and fresh-water tributaries, while 43 are found along the Pacific coast and fresh-water tributaries. So far none of the species has been found common to both areas.

This type of distribution is of considerable interest because it is contrary to what would be expected in the usual American tropical marine animal group. Ekman (1953, p. 38) has emphasized that on the whole the Atlantic fauna is richer than that of Western America with the possible exception of certain groups of crabs and echinoderms. Jordan (1905, p. 271) found that most of the common genera of fishes showed a much larger number of species on the Atlantic side and considered this to be evidence of their Atlantic origin. The heavy preponderance of clingfish species (including the majority of the American genera) in the tropical Eastern Pacific serves to indicate, if Jordan's reasoning is correct, that the Gobiesocinae probably originated in this area. It is here that the most advanced members of this subfamily are found with the primitive forms being confined to the north or south temperate areas, the Western Atlantic, or fresh-water streams.

As mentioned previously, the Gobiesocinae apparently stem from a form more closely resembling the genus *Diplocrepis* (of the Diplocrepinae) than any other. This genus is now confined to New Zealand, but it, or an immediate ancestor, probably was once very wide ranging, and evidently succeeded in passing over the deep water gap between Polynesia and America. The result was an immense flowering of species which spread to virtually all the suitable areas of the New World.

Some of these New World forms (four species of *Gobiesox*) even became adapted for existence in swift flowing, fresh-water streams, an event which has no parallel in the rest of the family. These form a notable portion of the complementary fresh-water fish fauna in the American tropics. The term "complementary" is used according to the definition of Myers (1949, p. 319) to indicate recent marine invaders of small streams which are not part of the major system so that there is little or no competition from members of the primary or secondary fresh-water fish fauna.

The complete separation of the Western Atlantic and the Eastern Pacific as far as species are concerned is not contrary to expectation since it is found in almost all shore-fish groups. Jordan (1905, p. 269) observed that many marine littoral fishes are common to both sides of the Isthmus of Panama.

In the Eastern Pacific the distribution of the various species has some interesting aspects. The problem of establishing the northern limit of the tropical fauna is particularly intriguing. Ekman (1953, p. 38) has just stated that a fairly general agreement exists among experts as to the delimitation of the warm water zone, the northern limit being regarded as roughly coincident with the border between the United States and Mexico. But in 1948 Carl L. Hubbs (p. 460) presented a well-documented paper showing that the general southward increase in temperatures and the increasingly tropical aspect of the fauna is reversed in northwestern Baja California, from near the California border southward through at least two and one-half degrees of latitude. This is due to upwelling in this area which has a very marked effect on both the offshore and inshore temperatures.

In view of this information it seems more suitable to adopt the conclusion of Steinbeck and Ricketts (1941, p. 302), based chiefly on inver-

tebrate distribution, that the tropical fauna has its northern limit at Cedros Island (about 28° N.). As far as the clingfishes are concerned, this boundary could be placed even farther south. The genus *Rimicola* seems to be well adapted to temperate waters, yet a species which is common in southern California, *R. eigenmanni*, ranges to San Juanico Bay, over 200 miles farther south. *Gobiesox rhessodon* is also common in southern California and extends to San Bartolomé Bay, a little less than 50 miles farther south.

The contentions of Ekman (1935, p. 71) and Clark Hubbs (1952, p. 154) that the Gulf of California represents a separate zoogeographic province of the Eastern Pacific region are well substantiated by the gobiesocid distribution. In the northern part of the Gulf (north of Guaymas) a total of six species are found, five of which are endemic. Some of these endemics range south of Guaymas in the Gulf but, with the single exception of *Gobiesox papillifer papillifer*, which reaches the southern part of Tiburón Island, none of the more southern species ranges north of this point.

Clark Hubbs (op. cit., p. 154) recognizes a Mexican Province between the Gulf of California and the Panamanian Province to the south. He believes that the genus *Paraclinus* acts as an index group for the fish fauna of the Tropical Eastern Pacific Region, and has proposed boundaries within this area principally on the basis of the distribution of this genus and some other members of the family Clinidae.

It seems reasonable to assume that zoogeographic boundaries, even when confined to the fish fauna, should be placed at locations where there are more taxonomic breaks (i. e., population separations) than at any other locality. Ordinarily, therefore, it does not seem possible to set up such boundaries with any real accuracy until a reasonably large part of the fauna concerned has been closely examined. Moreover, until such work has been done it does not seem useful to select an index genus, for there would be little assurance that it really acts as such. As a matter of fact, there has yet been comparatively little collecting done along the Southern Mexican and Central American coasts, and even such sparse collections as do exist in museums have had but a small amount of systematic work done on them.

The four most common southern Mexican clingfishes (*Arcos erythrops*, *Tomicodon eos*, *Tomicodon zebra*, and *Gobiesox adustus*) all range north to Guaymas, in the Gulf of California. If a Mexican Province were set up purely on the basis of the clingfish distribution, the northern boundary would have to be at Guaymas rather than just north of Mazatlán as proposed by Clark Hubbs (op. cit., p. 154).

Three of the four above species range south to the northern part of the Gulf of Tehuantepec while the fourth, *Gobiesox adustus*, is found all the way to Ecuador. This is the only species which ranges past the Gulf of Tehuantepec, and none of the more southern forms come any further north. Therefore, strictly on the basis of the present knowledge of the clingfishes, the southern border of the Mexican Province could be set at about Tangola-Tangola Bay in the Gulf of Tehuantepec instead of Bahia Honda, Panama, as was indicated by Clark Hubbs' study of the clinids. As other fish groups are investigated, the resultant data may be even more conflicting than is demonstrated by these two.

The region of warmest waters in the Eastern Pacific is generally referred to as the Panamanian Province or faunal area. It may be defined as extending from the southern edge of the Mexican Province, wherever that may be, to a point between southern Ecuador and northern Peru. Most authors are in agreement about the general vicinity of this southern boundary. Myers (1941, p. 206) makes a definite placement just below the Guayas es-

ry at Cape Aguja, Peru.[1] Ekman (1953, p. 38) states that it must lie this location or even farther north at Guayaquil Bay on the border be- en Ecuador and Peru. It should be noted that two of the tropical cling- hes range southward considerably past this latter area (*Gobiesox multi- taculus* to Paita, Peru, and *Tomicodon petersi* to Lobos de Tierra Island, u).

As may be expected of a fish group which is predominantly adapted to llow and often intertidal areas, the clingfishes which have spread to more distant offshore islands show a strong tendency to evolve into olated species.

Guadalupe Island, off Baja California, has two endemic species, *Rimicola a* and *Gobiesox eugrammus*, both of which are described as new in this er. It was interesting to find that these forms are most closely re- ed to mainland species which now occur at latitudes much farther north n this island. If, as Clark Hubbs (1952, p. 154) assumes, the Guadalupe na was mainly derived from forms migrating from the south through Cedros land and the San Benito Islands, the two clingfishes must have made the p when the ocean temperatures were considerably cooler than at present.

The isolated, offshore Revilla Gigedo Archipelago has three known en- ic species, one from Clarión Island (*Gobiesox aethus*) and the other two m Socorro Island (*G. canidens* and *Tomicodon absitus*). The two *Gobiesox* most closely related to *G. adustus*, the wide-ranging, tropical American ecies. The *Tomicodon* is closest to *T. boehlkei*, a form which is appar- tly confined to the Gulf of California. The Tres Marías Islands are lo- ted much closer to the mainland shore and the clingfish fauna shows no rphological evidence of isolation. Cocos, another isolated, offshore land, has three endemics, *Tomicodon vermiculatus*, *Gobiesox woodsi* and *G. lvus*, the latter occurring in the swift portion of a fresh-water stream. *vermiculatus* is most closely related to *T. myersi*, a form apparently nfined to northern Mexico; *G. woodsi* seems to be closer to *G. adustus* an to any other mainland species; and *G. fulvus* is quite close to *G. radoensis*, which is found in the fresh-water streams of Gorgona Island d Colombia.

The Galápagos Islands are interesting both from the standpoint of affin- ies and the degree of isolation exhibited by the fauna. Ekman (1953, p.) has stated, "The Galapagos Islands must be regarded as belonging to the gion of the tropical fauna. This is true of the surface layers of the ters." On the other hand Myers (1941, p. 204) has observed that the lápagos Islands contain a number of Panamanian forms, but that the rather or shore-fish fauna has perhaps as much in common with the temperate uth American fish fauna. Clark Hubbs (op. cit., p. 155) also found, on e basis of his clinid studies, that the fishes were derived from more an one faunal region. The results of this clingfish study afford some pport to the views of Myers and Hubbs since one species (*Tomicodon chil- sis*) shows temperate affinity while the other two (*T. petersi* and *Arcos ecilophthalmus*) are of tropical origin. It may be added that, as Ekman mself has pointed out, the penguin *Spheniscus mendiculus* occurs in these lands and it is undeniably a shallow water inhabitant of south temperate igin.

Of the three Galápagos clingfishes only one, *Arcos poecilophthalmus*, is demic. It is noteworthy that the most closely related mainland species, *macrophthalmus*, is not found in the Eastern Pacific but in the tropical stern Atlantic. Presumably, this indicates that the island colonization

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he boundary shifts in years during which the warm El Niño current sweeps uthward along the Peruvian coast.—G. S. Myers.

of this form took place close or during the time when the Isthmus of Panama was innundated.

There are two species at Juan Fernández Island off the coast of Chile. The one endemic, *Sicyases brevirostris*, seems to be very close to the common, south temperate, mainland form *S. sanguineus*. *Gobiesox marmoratus* is apparently indistinguishable from the mainland population. [1]

It is predicted that other isolated species will be found when better collections are taken at such islands as the San Félix-San Ambrosio-Gonzales group, Malpelo, Clipperton, and the Roca Alijos.

One of the most striking aspects of the clingfish distribution of the Western Atlantic is the absence of both northern and southern temperate-water species, while 11 such forms are found in the temperate regions of the Eastern Pacific. In the Atlantic the widespread tropical form, *Gobiesox strumosus*, ranges to New Jersey in the north, well beyond Cape Hatteras which is usually considered the limit of the tropical shore fauna in general. This same species extends far south to Santos, São Paulo, Brazil. This is a short distance south of Rio de Janeiro where Ekman (1953, p. 47) presumes the southern West Indian faunal barrier should be placed, although he does point out that some tropical species are found as far south as the mouth of the La Plata River.

Of the remaining 10 Western Atlantic species, five occur in both the West Indian islands and the mainland shore areas, four are apparently confined to the islands, and one, *Gobiesox nudus*, is found only in fresh-water streams.

Upon examination of a specimen of *Eckloniaichthys scylliorhiniceps* it was surprising to find that it belonged to the Gobiesocinae since all of the other species in this subfamily are confined to the New World. As has been mentioned previously, *Eckloniaichthys* is most closely related to *Rimicola* and *Acyrtops*. It seems logical to suppose that all three of these genera arose from a common ancestral form which may have had a widespread distribution in the Americas. If this was the case, the presence of *Eckloniaichthys* in South Africa (map 13) is almost certainly due to this primitive form having made the jump across from South America or the West Indies. Such South Atlantic Ridge islands as Ascension and St. Helena may have aided in the migration of this as well as other shore fishes.

ASPASMINAE

Map 14

The distribution of this subfamily is of particular interest because the three genera have been found only in the Northwestern Pacific (map 14). *Liobranchia* is from Saipan, *Aspasmichthys* extends from Taiwan north to Japan and Korea, and *Aspasma* is from Hon Shu Island, Japan. As far as is known, none of the Japanese clingfishes are found north of Inubo Cape (Inuboye Zaki) near Chōshi, the point which, according to Tanaka (1931a, p. 60), divides the northern and southern faunal areas of marine fishes. Therefore, despite the northerly disposition of this subfamily, it can still be considered part of the tropical fauna, since it remains within the influence of the warm Kuro Shio current. It is probable that when more collecting is done all three genera will be found farther to the south.

[1] The single specimen examined was very small and could not be compared properly with the larger mainland individuals.

DIADEMICHTHYINAE

Map 15

This, the most advanced subfamily, is represented by two genera, both
d in the warm, tropical waters from the Indian Ocean to the Indo-Paci-
(map 15).
There are four species of *Lepadichthys*, *L. coccinotaenia* in East Africa,
andaracatus in Western Australia, *L. frenatus* from Australia to Japan,
L. minor from New Caledonia to Samoa to the Celebes Sea. The monotypic
is *Diademichthys* is found from New Caledonia to the Indian Ocean and
h to the Philippines.

ZOOGEOGRAPHICAL CONCLUSIONS

When the distributional picture as a whole is analyzed some facts be-
apparent which are of importance to the understanding of shore fish
ribution and, perhaps, to the field of zoogeography in general. In the
gfishes there is a clear-cut relationship between the distributional
evolutionary patterns. The two most highly advanced subfamilies are
d only in the tropical waters of the Western Pacific and Indian oceans.
the exception of but three species, the distribution of the other six
amilies is of a fringe or relict type.
n general, it may be said that the most primitive species are those
are best isolated, occurring on the periphery of the area inhabited by
family. Furthermore, with the exception of the three species referred
bove and some members of the Gobiesocinae, the more generalized forms
found in temperate rather than in tropical waters.
hese situations strongly indicate that the tropical Indo-Pacific is the
on in which the gobiesocids originated. This area fulfills the con-
ons laid down by Matthew (1915, p. 200) for a "center of dispersal"
e it is inhabited by the most progressive species, with the most prim-
e generally being the most remote, either in terms of geographic dis-
e or of inaccessibility to invasion.
here is another widely accepted theory in biogeography that the center
ispersal of a group is where the greatest numbers of species are con-
rated. If this rule is applied to the Gobiesocidae, the tropical East-
Pacific would have to be considered the area of origin for the family.
he paleontological literature lists many instances, particularly among
mammals, where the predominant adaptive evolution took place in areas
removed from the center of origin. The extensive radiation of the mar-
als in Australia and Tasmania is a good example since this group is
only believed to have risen in the holarctic region. Simpson (1950,
361-389) has listed many similar cases from the neotropical region
re primitive migrants from North America encountered a fertile area for
nsion). Cain (1944, p. 190) very capably pointed out the possibility
uch an occurrence in his book on the geography of plants. The distri-
onal pattern has been relatively easy to complete in many such cases,
fossil evidence giving proof of occupancy in areas where living repre-
atives no longer exist. However, when one considers advanced marine
thopterygian fishes, the task is made more difficult because such evi-
e is extremely rare. This necessitates placing an almost complete

reliance upon an interpolation from the geography of the living species.

The Eastern Pacific is believed to be a fortuitously derived center of differentiation constituting *a secondary region* of evolution and dispersal. The ancestral form apparently came from the Western Pacific and, having encountered an area where the competition pressure was relatively low, underwent a "burst" of evolutionary radiation resulting in a concentration of 43 known species, almost half the recognized total for the entire order

NEW SYSTEMATIC NAMES

New Subfamilies	New Species
Trachelochismin ae	Dellichthys morelandi - New Zealand
Haplocylicinae	Diplecogaster megalops - South Africa
Chorisochismin ae	Diplecogaster ctenocrypta - Canary Islands
Diplocrepinae	Pherallodus smithi - South Africa
Aspasminae	Gastrocyathus gracilis - New Zealand
	Aspasmogaster liorhynchus - Australia
New Genera	Tomicodon myersi - Pacific Mexico
	Tomicodon vermiculatus - Cocos Island, E. Pacific
Gastrocymba	Tomicodon boehlkei - Gulf of California
Creocele	Tomicodon absitus - Socorro Island, E. Pacific
Dellichthys	Acyrtops amplicirrus - Virgin Islands
Conidens	Rimicola dimorpha - Pacific Mexico
Haplocylix	Rimicola sila - Guadalupe Island, E. Pacific
Opeatogenys	Gobiesox stenocephalus - Pacific Costa Rica
Apletodon	Gobiesox potamius - Pacific Costa Rica
Pherallodus	Gobiesox eugrammus - Guadalupe Island, E. Pacific
Gastroscyphus	Gobiesox milleri - Pacific Costa Rica
Gastrocyathus	Acyrtus artius - Curacao Island, Caribbean
Pherallodiscus	Pherallodiscus varius - Pacific Mexico
Liobranchia	Liobranchia stria - Saipan, Marianas Islands
Aspasmichthys	Lepadichthys minor - Southwest Pacific

New Subspecies

Diplecogaster bimaculata pectoralis - Canary and Cape Verde Islands
Tomicodon fasciatus australis - Brazil
Tomicodon eos rhadinus - Pacific Mexico
Gobiesox daedaleus boreus - El Salvador

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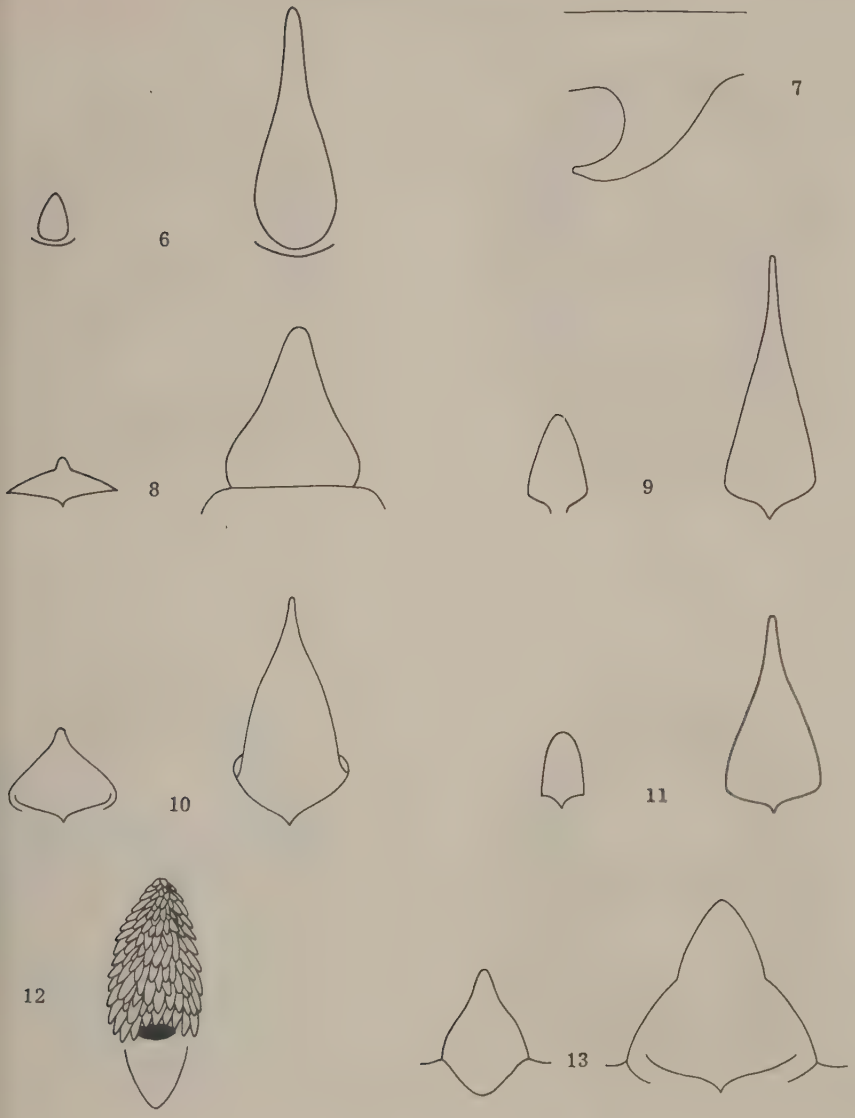
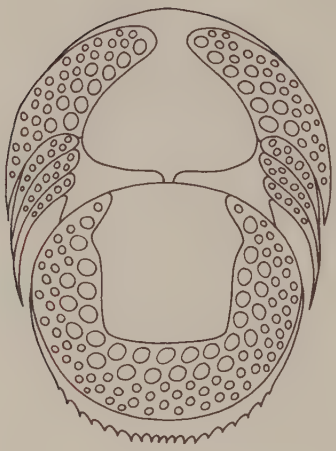


Figs. 6-13. External sexual dimorphism in the Gobiesocidae. In the paired figures, females at left, males at right. Fig. 6. Urogenital papillae, *Gastroscyphus*. Fig. 7. Lateral outline, urogenital papilla, breeding male, *Parvicrepis parvipinnis*. Fig. 8. Urogenital papillae, *Sicyases*. Fig. 9. Same, *Acyrtops*. Fig. 10. Same, *Rimicola muscarum*. Fig. 11. Same, *Arcos*. Fig. 12. Fleshy, spine-shaped growths, pre-anal region, female *Acyrtus*. Fig. 13. Urogenital papillae, *Pherallodiscus*.



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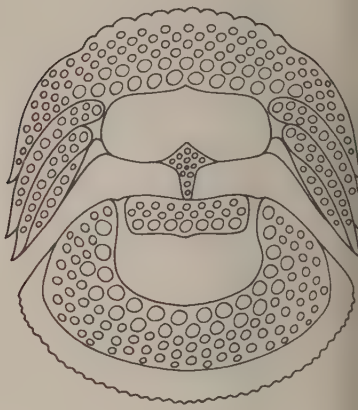

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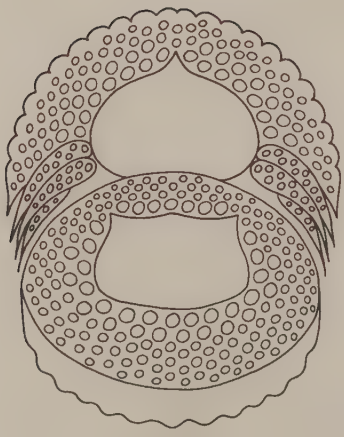

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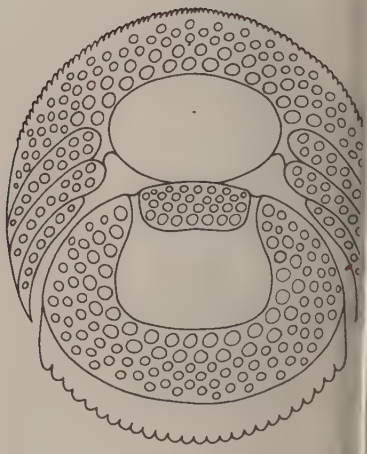

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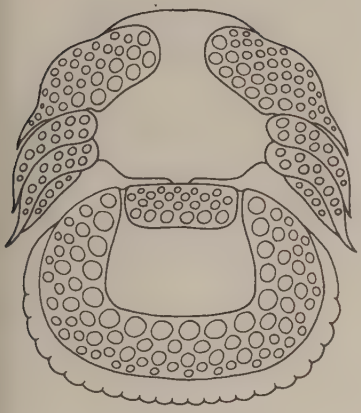
Figs. 14-17. Disc diagrams. Fig. 14. *Gastrocymba*. Fig. 15. *Creocele* Fig. 16. *Dellichthys*. Fig. 17. *Conidens*.



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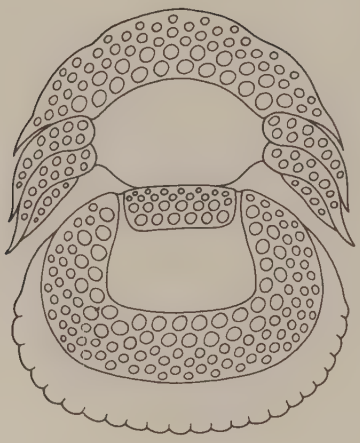

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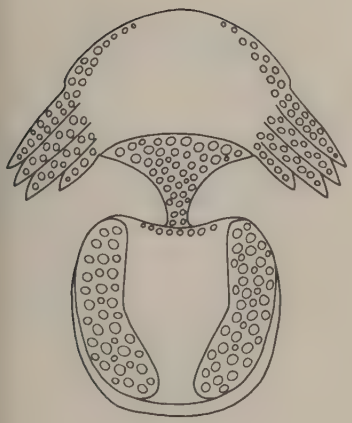

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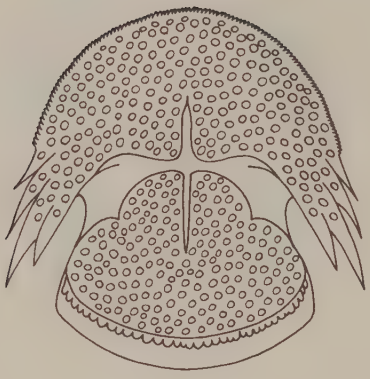
Figs. 18-21. Disc diagrams. Fig. 18. *Trachelochismus pinnulatus*. Fig. 19. *Trachelochismus melobesia*. Fig. 20. *Haplocylix*. Fig. 21. *Lepadogaster*.



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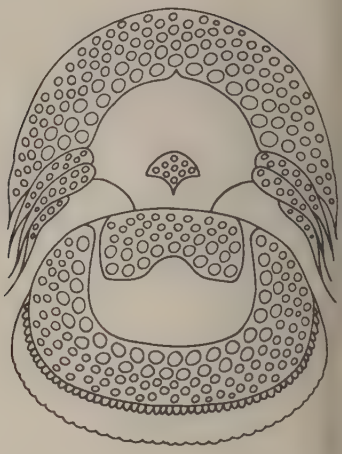

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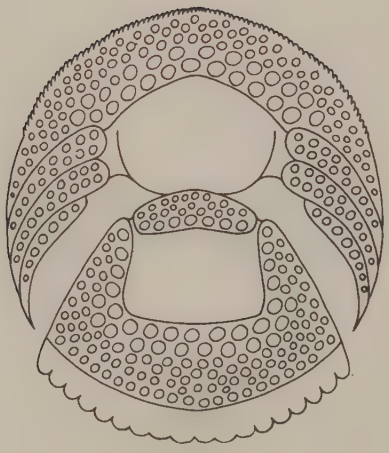

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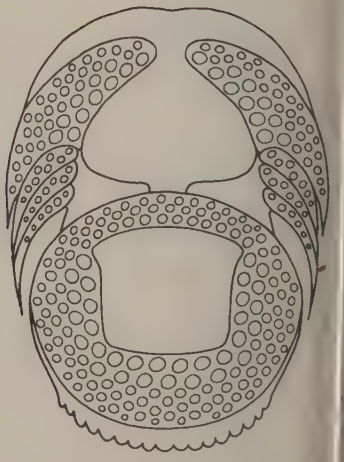

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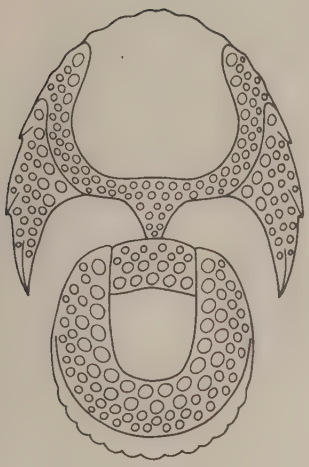
Figs. 22-25. Disc diagrams. Fig. 22. *Chorisochismus*. Fig. 23. *Diplocrepis*. Fig. 24. *Pherallodus smithi; P. indicus* has but a single row of papillae across width of region C. Fig. 25. *Gastroscyphus*.



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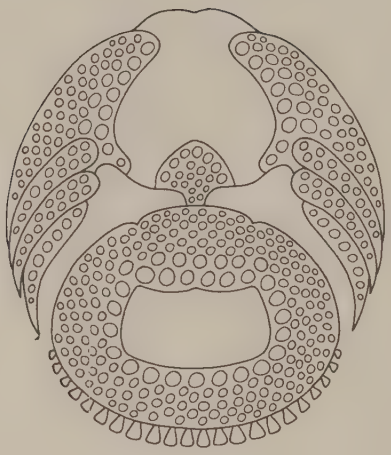

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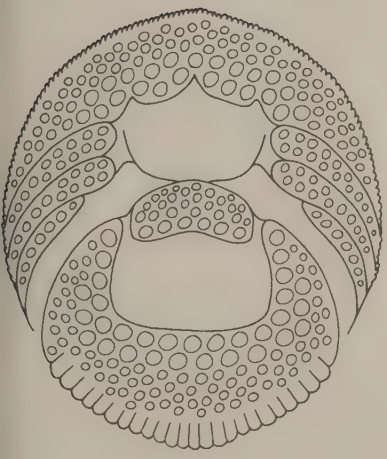

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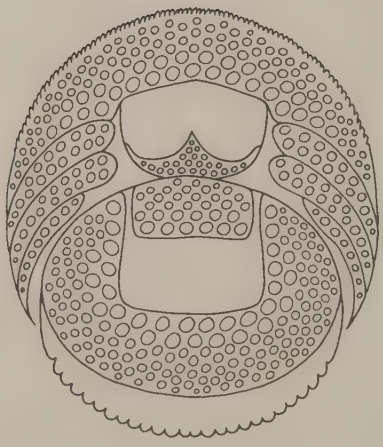

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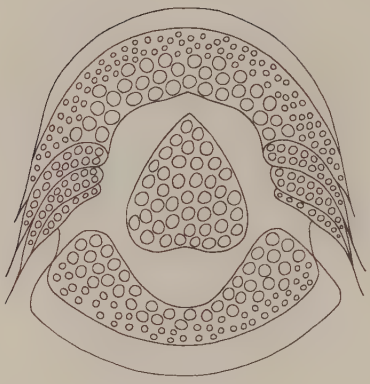
Figs. 26-29. Disc diagrams. Fig. 26. *Gastrocyathus*. Fig. 27. *Parvicrepis*. Fig. 28. *Aspasmogaster*. Fig. 29. *Cochleoceps*.



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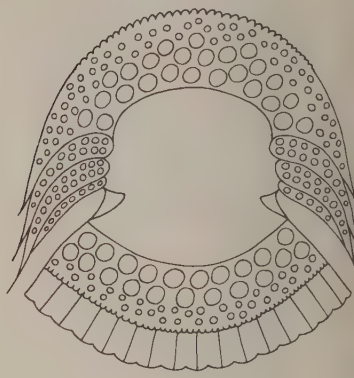

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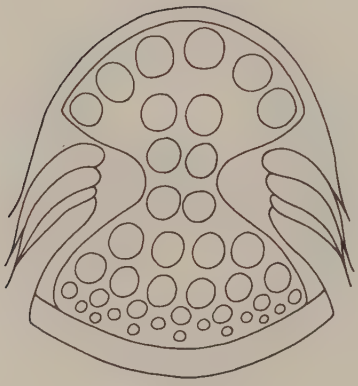

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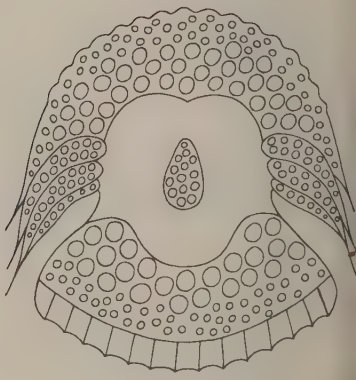

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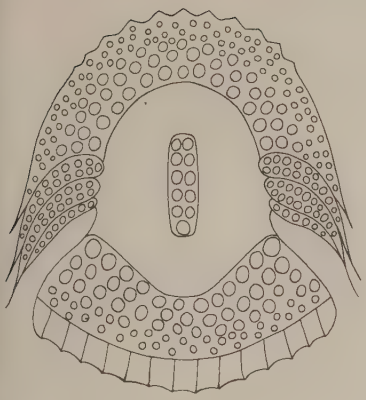
Figs. 30-33. Disc diagrams. Fig. 30. *Sicyases*. Fig. 31. *Tomicodon*. Fig. 32. *Ecklonialchthys*. Fig. 33. *Acyrtops*.



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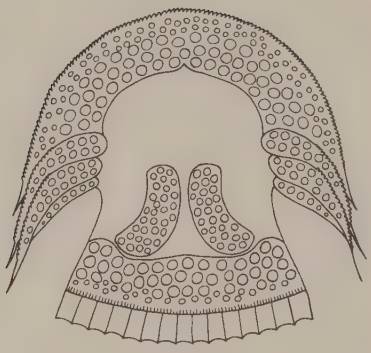

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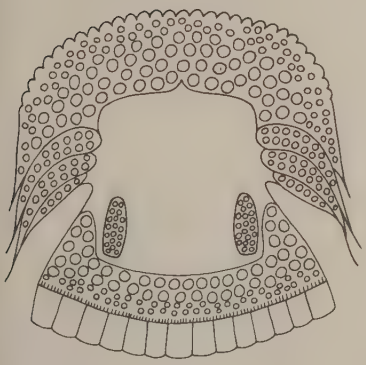

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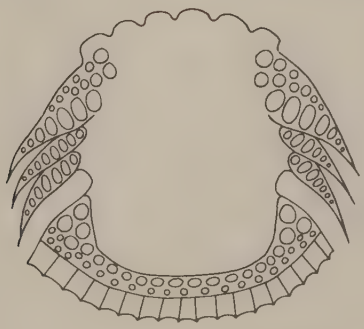

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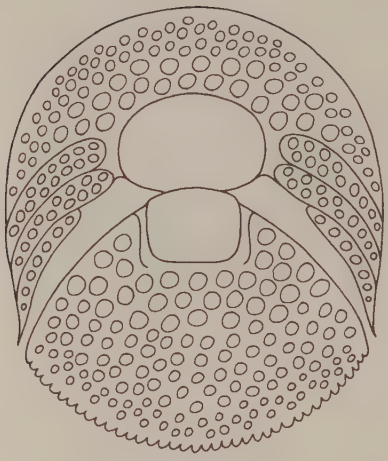
Figs. 34-38. Disc diagrams. Fig. 34. *Rimicola.* Fig. 35. *Arcos.* Fig. 36. *Gobiesox.* Fig. 37. *Acyrtus artius; A. rubiginosus* lacks the two clusters of papillae in the central region (region C). Fig. 38. *Pherallodiscus.*



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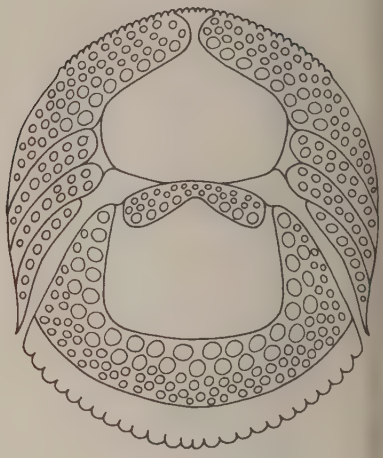

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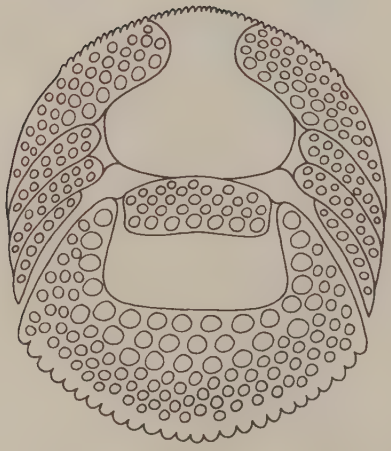

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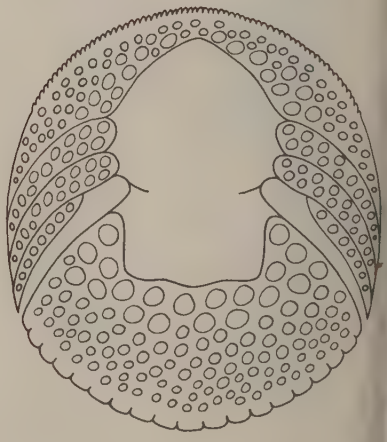

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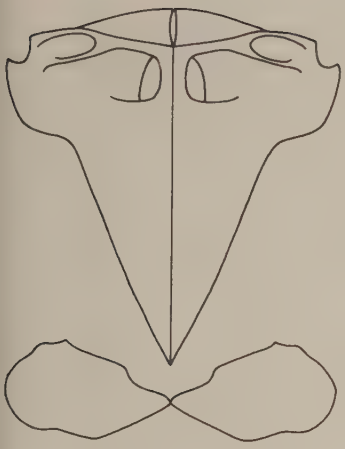
Figs. 39-42. Disc diagrams. Fig. 39. *Liobranchia*. Fig. 40. *Aspasmichthys*. Fig. 41. *Aspasma*. Fig. 42. *Lepadichthys*.



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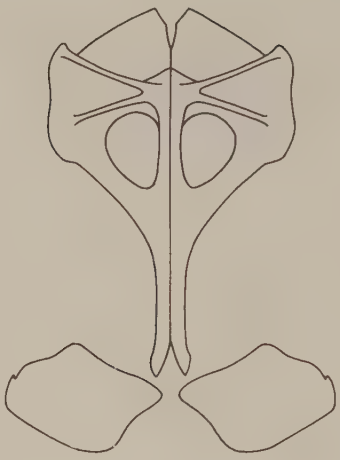

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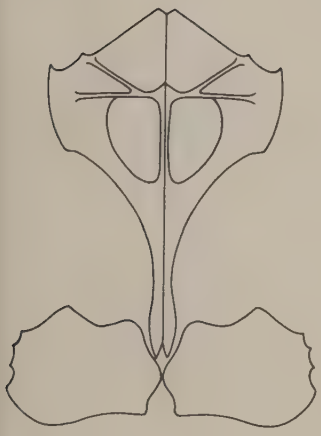

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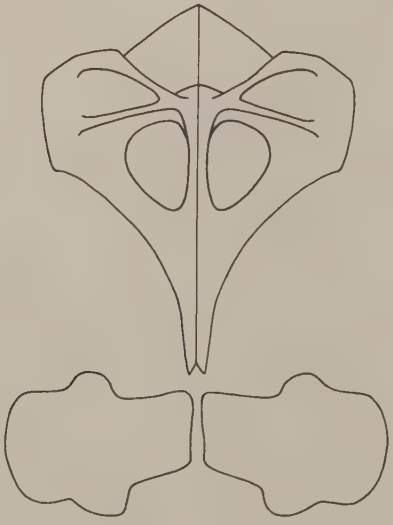

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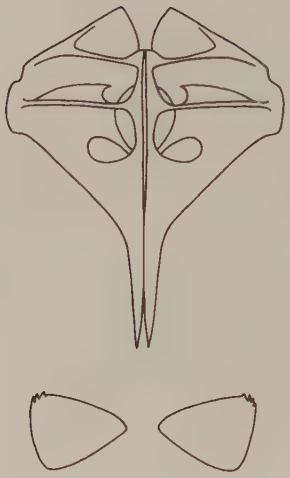
Figs. 43-46. Outline of bony disc supports. Fig. 43. *Creocele*. Fig. 44. *Dellichthys*. Fig. 45. *Conidens*. Fig. 46. *Trachelochismus*.



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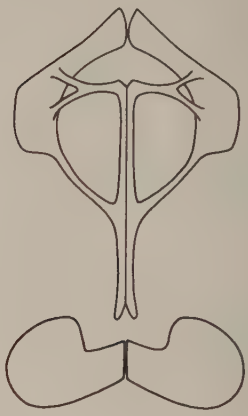

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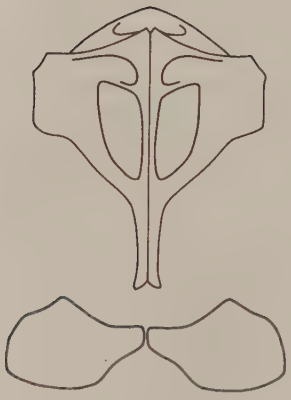

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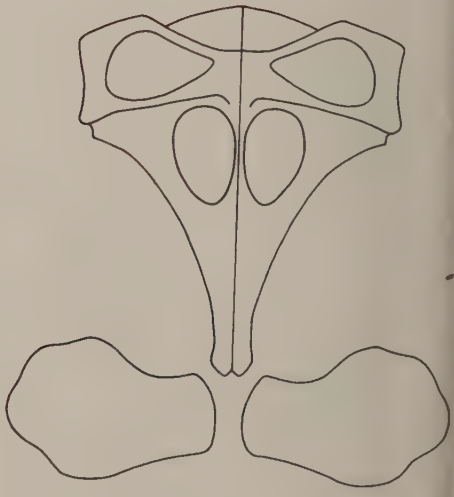

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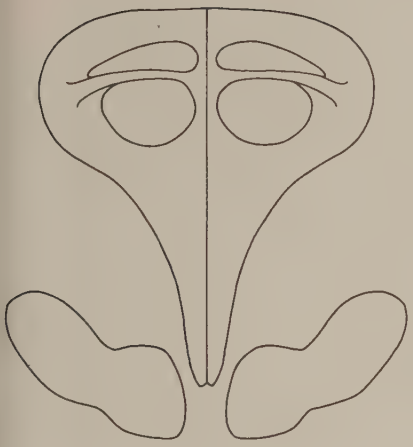
Figs. 47-50. Outline of bony disc supports. Fig. 47. *Haplocylix*. Fig. 48. *Gouania*. Fig. 49. *Diplecogaster*. Fig. 50. *Lepadogaster*.



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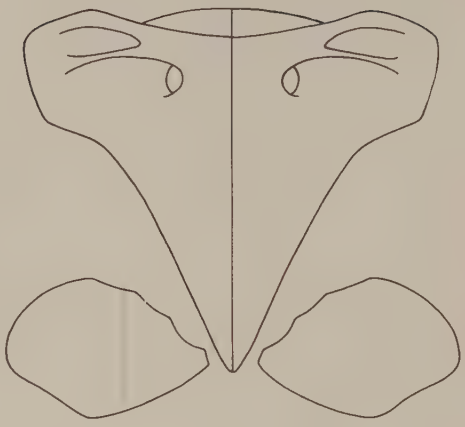

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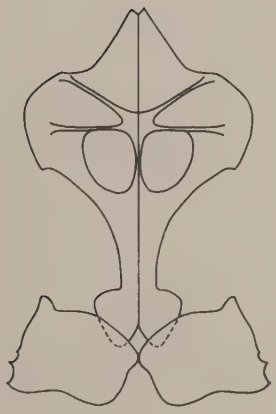

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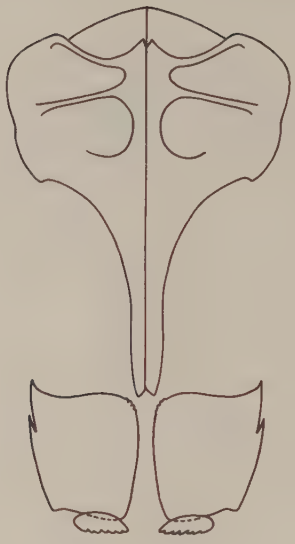
Figs. 51-54. Outline of bony disc supports. Fig. 51. *Chorisochismus*. Fig. 52. *Diplocrepis*. Fig. 53. *Pherallodus indicus*. Fig. 54. *Gastroscyphus*.



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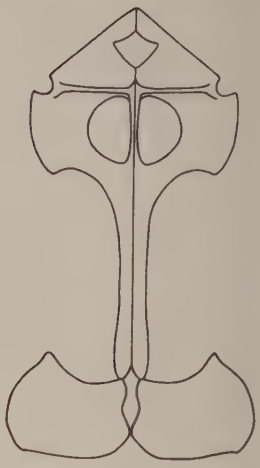

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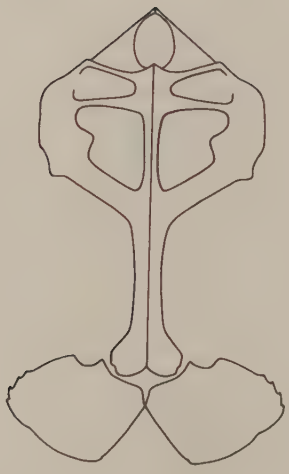

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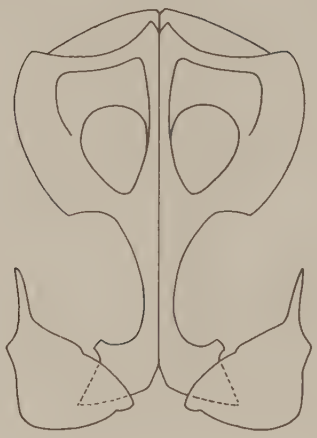

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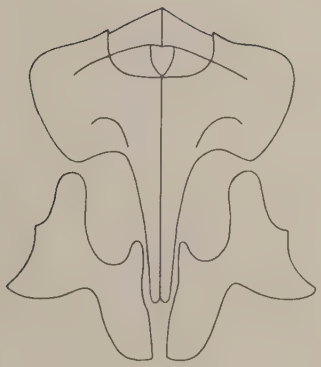

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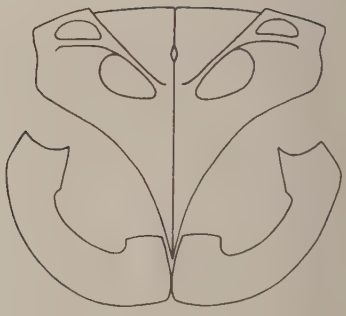

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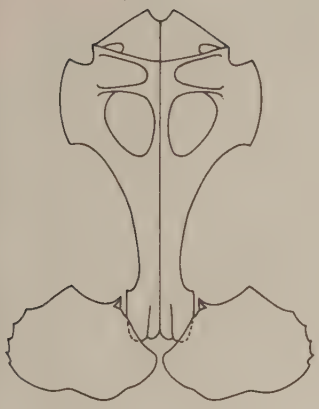

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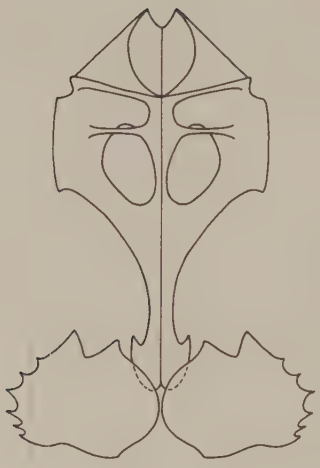

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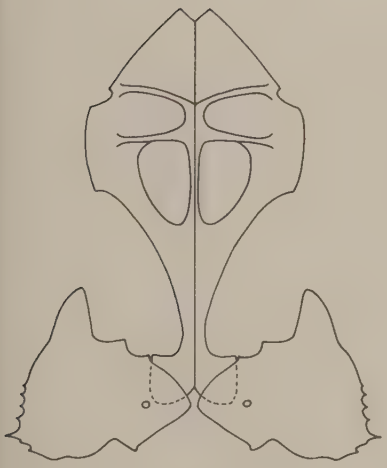

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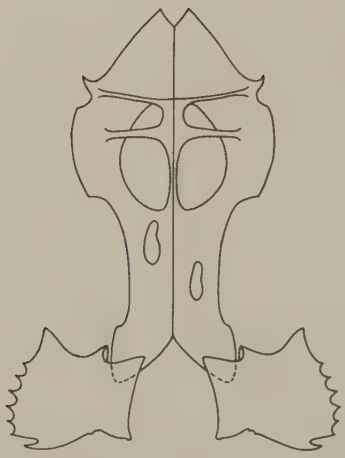

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A

B

C

D

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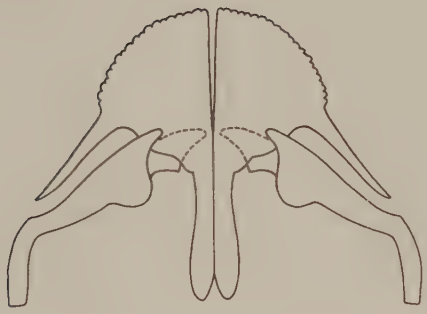

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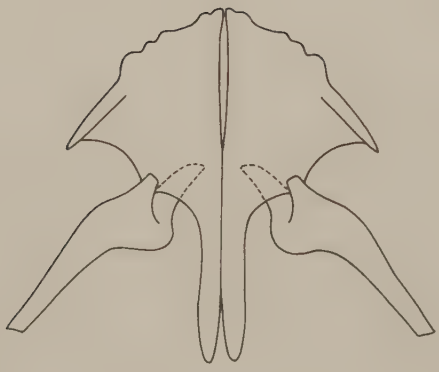

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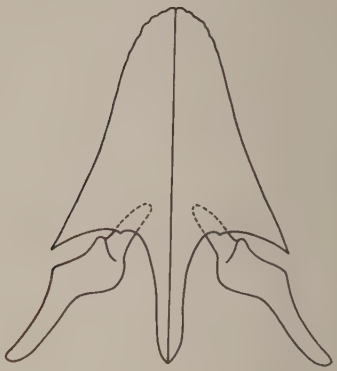

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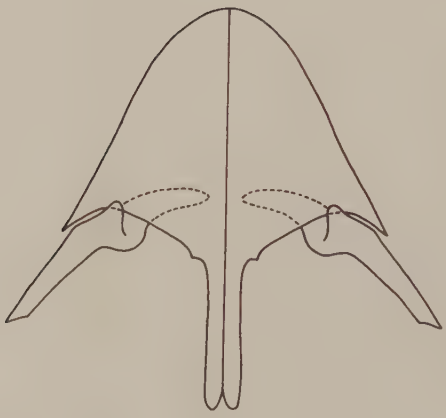

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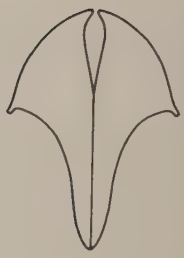

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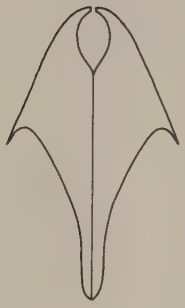

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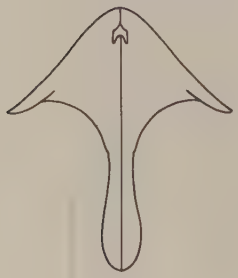

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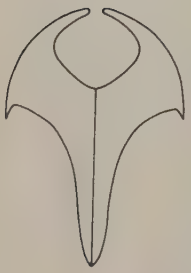

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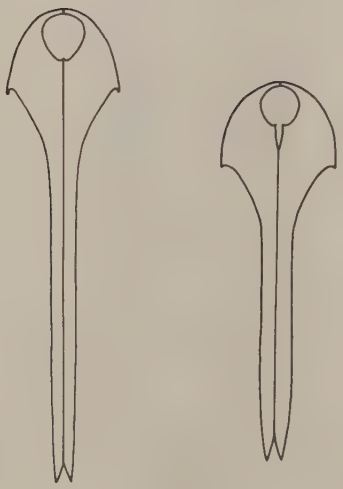

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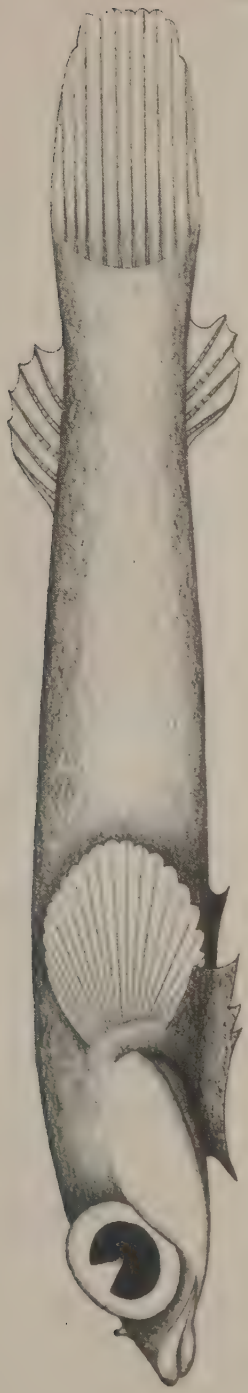

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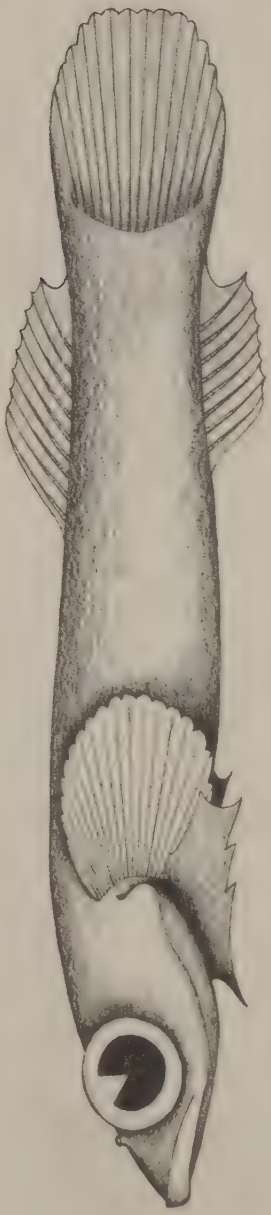

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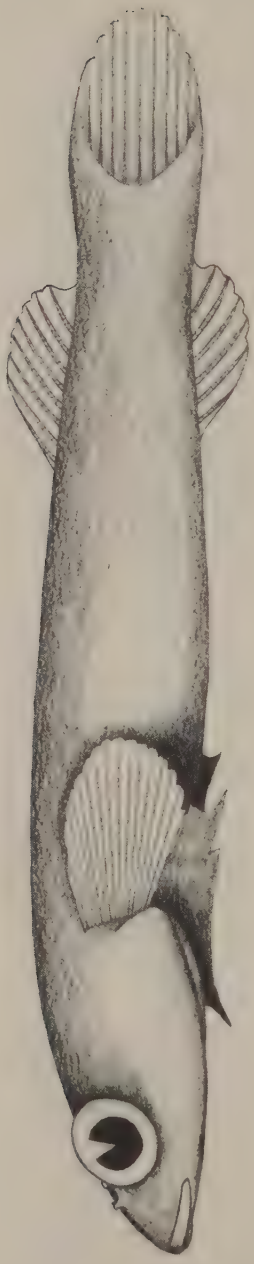

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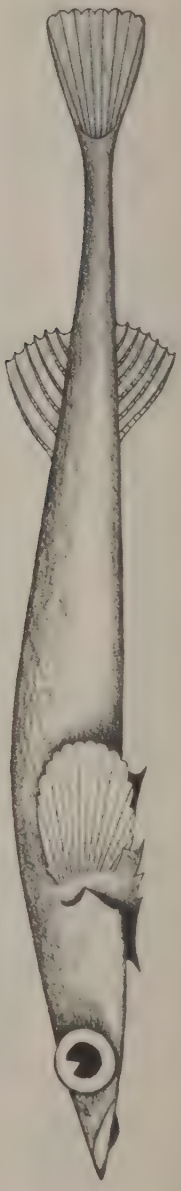

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Fig. 89. *Tomicodon vermiculatus.*

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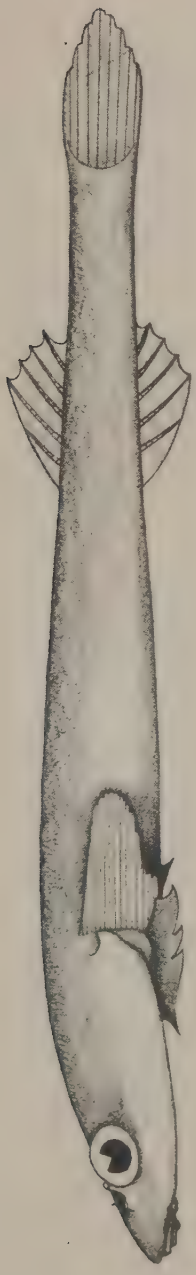

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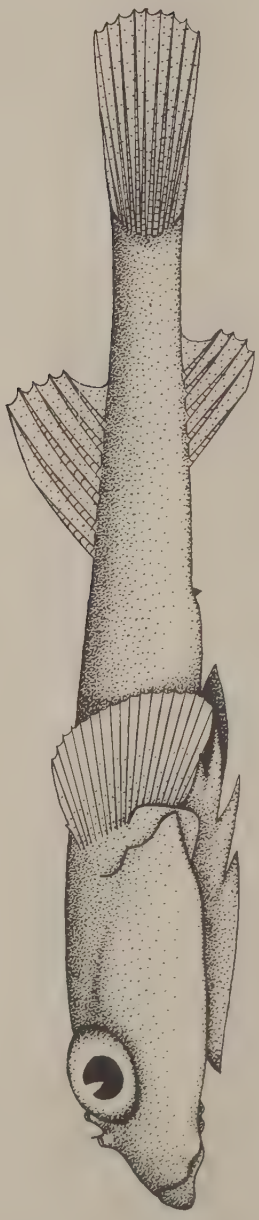

Fig. 97. *Arcos erythros.*

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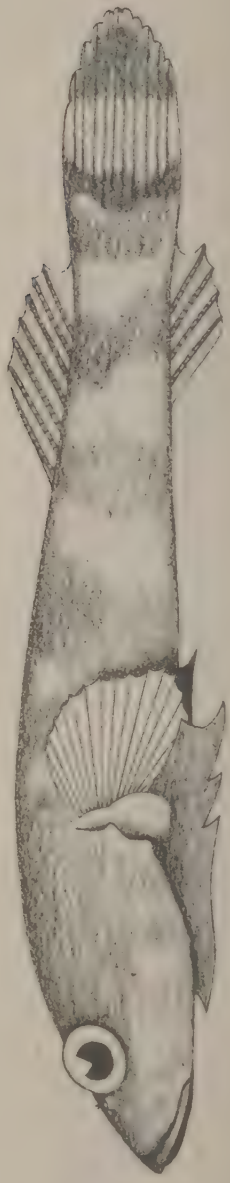

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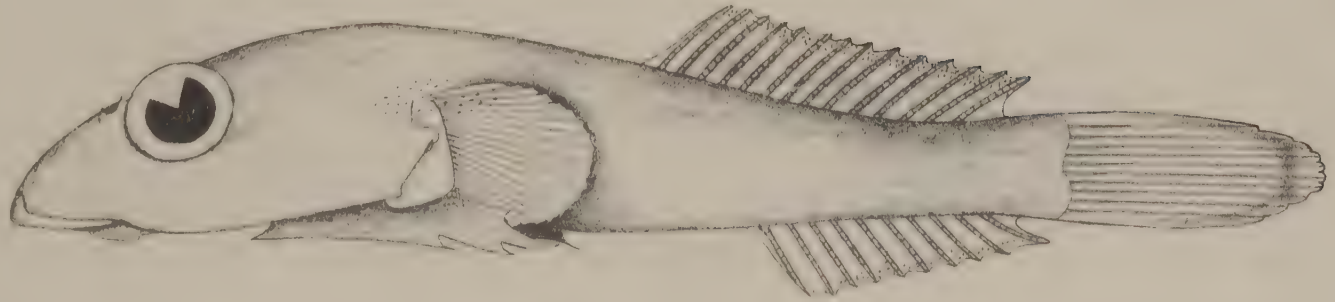

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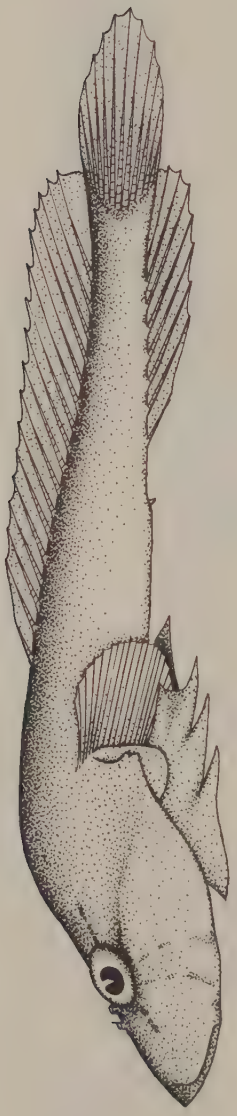

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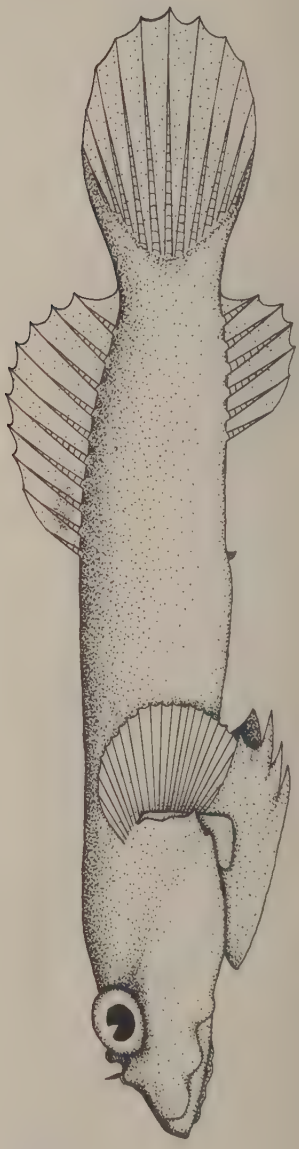

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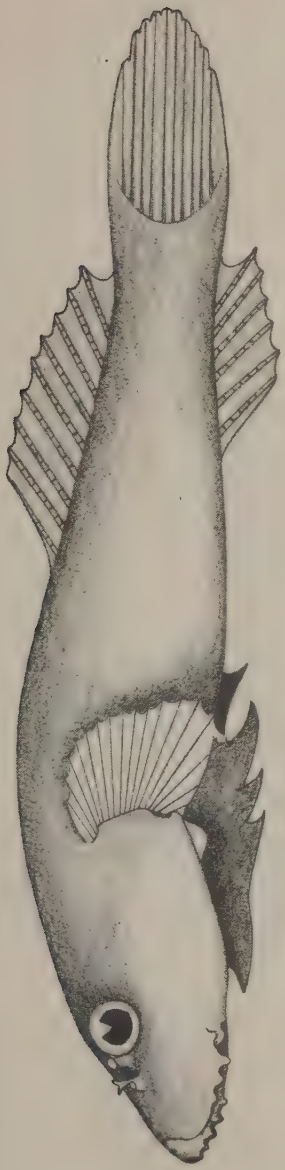

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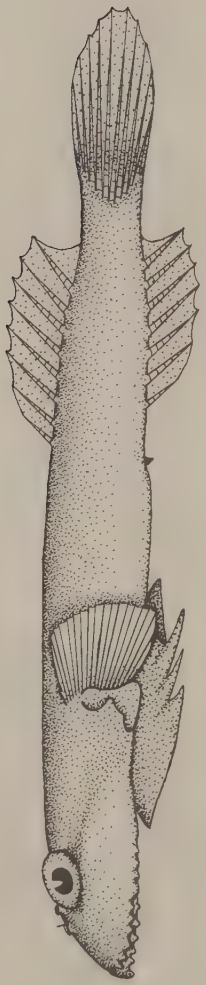

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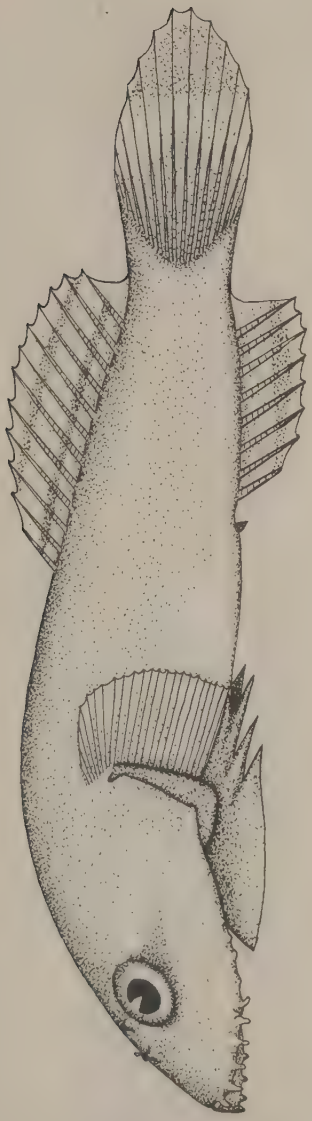

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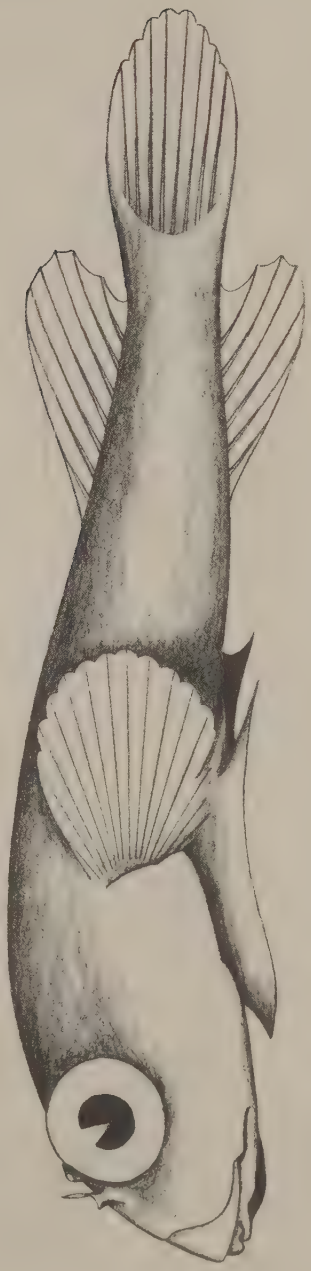

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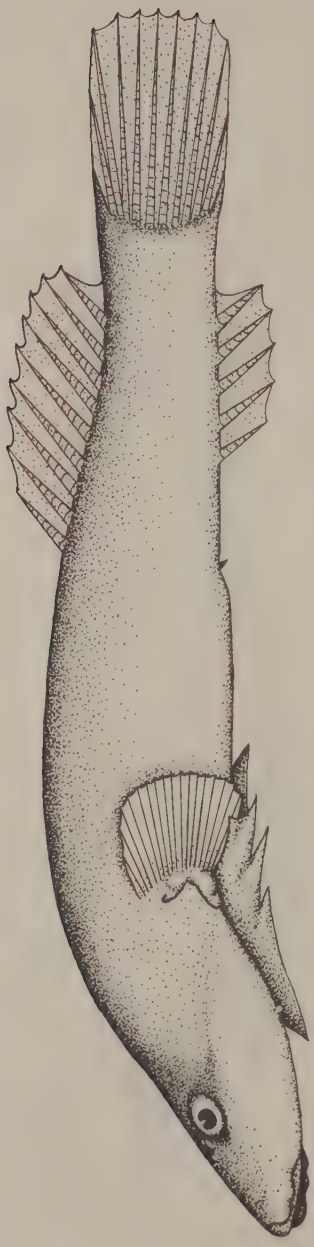

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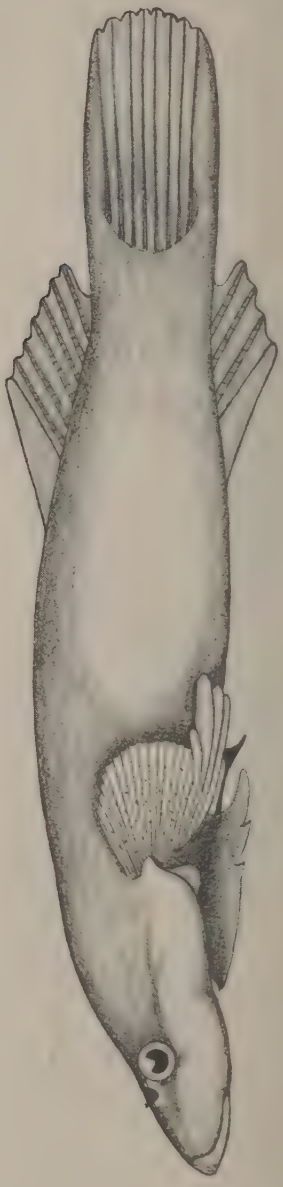

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Fig. 112. *Liobranchia stria.*

Fig. 113. *Lepadichthys minor.*

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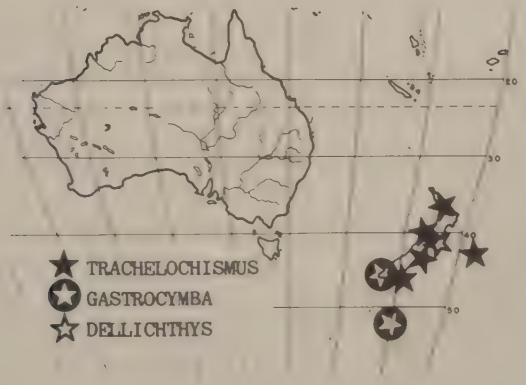
Map 1. Distribution of the genera *Creocele*, *Conidens* and *Haplocylix*.

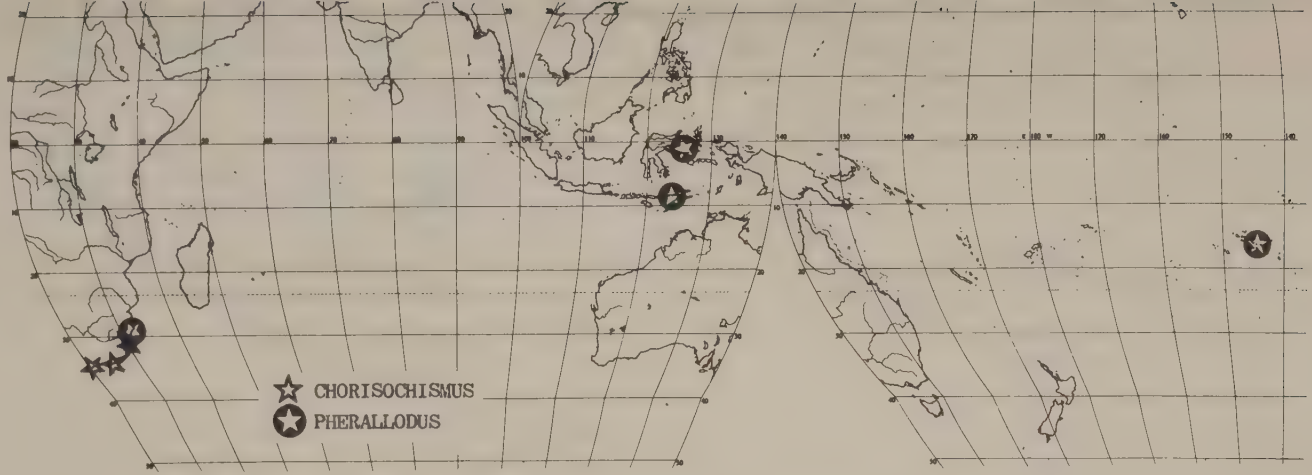


Map 2. Distribution of the genera *Trachelochismus*, *Gastrocymba* and *Dellichthys*.

Map 3. Distribution of the genus *Lepadogaster*.

Map 4. Distribution of the genus *Diplecogaster*.

Map 5. Distribution of the genera *Gouania*, *Opeatogenys* and *Apletodon*.



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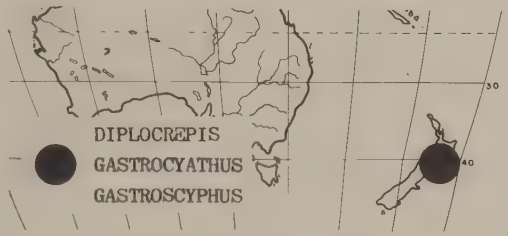

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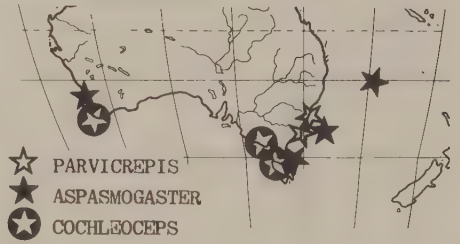

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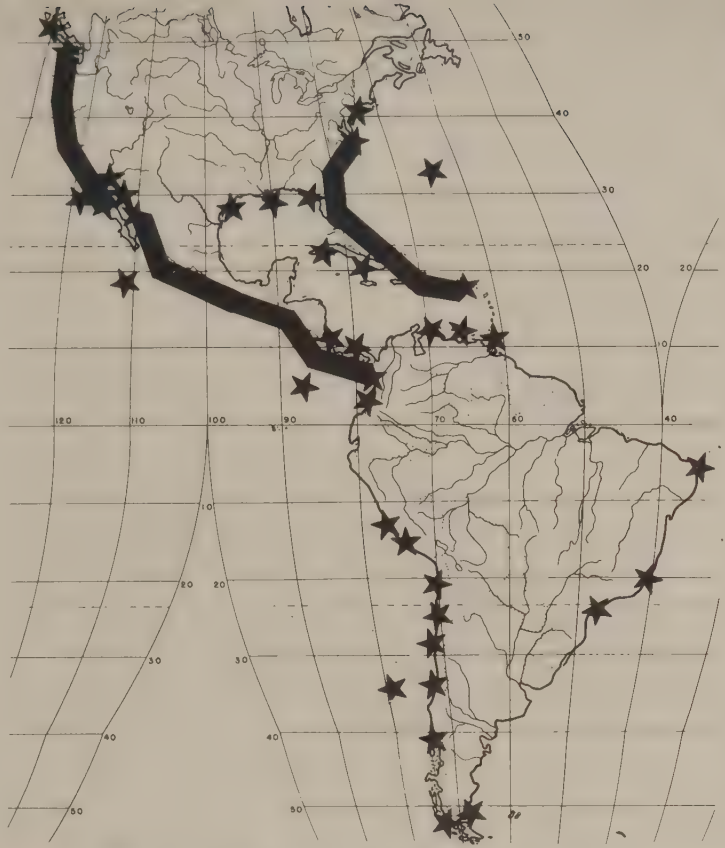

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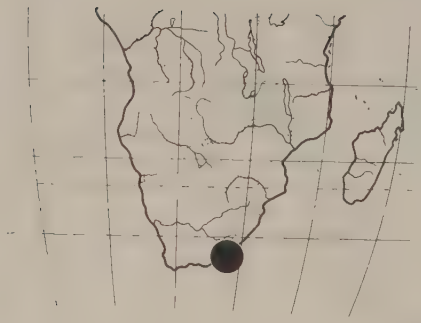

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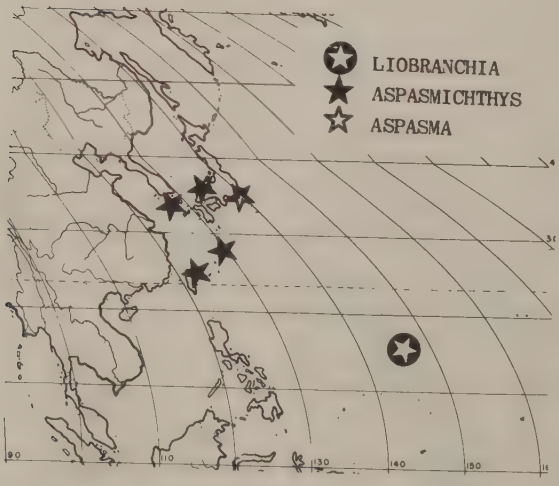

Map 14. Distribution of the genera *Liobranchia*, *Aspasmichthys* and *Aspasma*.

Map 15. Distribution of the genera *Lepadichthys* and *Diademichthys*.

NOTE

While this monograph was in press the author, fortunately, was able to procure a copy of the *Fishes of Bulgaria* (in Russian) by P. Drensky which was published in 1951 but has not been generally available to western biologists. This book is important because it extends the range of two species *(Diplecogaster bimaculata* and *Apletodon microcephalus)* from the Mediterranean to the Black Sea. Also, reference is made to a subspecies of *A. microcephalus (A. m. bacescui)* described in a Romanian journal by Antonio-Murgoci (1940). It is possible that this is a distinct form, since the number of dorsal rays listed (eight) is more than has been recorded for any specimen of *A. microcephalus* from other areas.

ADDITIONAL REFERENCES

ANTONIO-MURGOCI
1940 Étude sur quelques espèces du genre Lepadogaster de la Mer Noire. C. R. Acad. Sci. Roum. Tome 4, no. 5. (Not seen.)
DRENSKY, P.
1951 Fishes of Bulgaria. Bulgarian Acad. Sci., Fauna of Bulgaria no. 2, 270 pp., 172 figs. (In Russian.)

EPILOGUE

I have had the privilege of working on a valuable and beautiful group of fishes. However, their value is not economic but biological and their beauty lies in their marvelous adaption to their habitat.

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